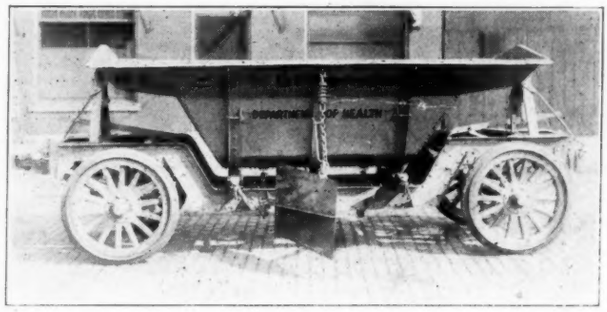
Engineering Library
MAR-5 1920
UNIV. OF MICH

PUBLIC WORKS.

CITY COUNTY STATE

A COMBINATION OF
"MUNICIPAL JOURNAL & PUBLIC WORKS" and "CONTRACTING"

LEE LINE



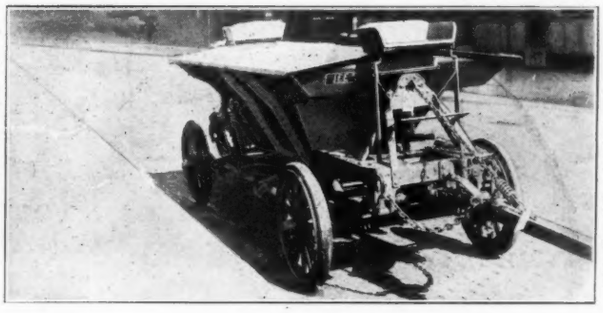
Bridgeport, Conn.

DEPARTMENT OF HEALTH

uses

Lee Drop Frame Trailers

Sixteen of them, with four heavy tractors, increase efficiency and speed of collection, at the same time bringing down costs and reducing the number of complaints by citizens to a minimum.

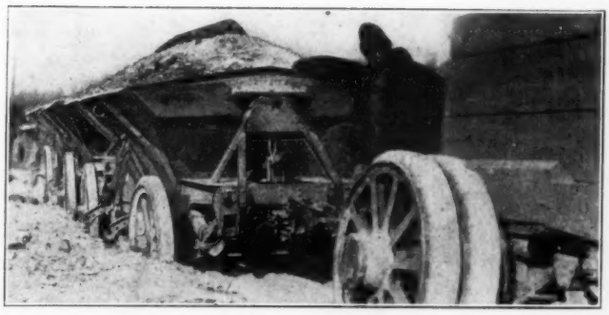


Commissioner of Public Works Courtrade or President W. E. Seeley of the Board of Apportionment will give information of Bridgeport's successful crusade toward perfection in sanitary conditions.

For Garbage and Ash Collection

Lee drop frame trailers with watertight dump bodies are unequalled, as is proved in all cities which have adopted the Lee system.

If it is a Trailer, Semi-Trailer, Motor Truck or Trailer Body or special handling or hauling equipment—we make it.



LEE LOADER & BODY CO.

Builders of Automotive Auxiliary Equipment

2330 S. La Salle St. Chicago

LOW LOAD

Speaking of CONCRETE ROADS STREETS and ALLEYS

53,000,000 Square Yards Were Placed Under Contract During 1919—

Over twice that of any previous year. Every state—your state—contributed to this total. Public preference is expressed in this record. Watch 1920!

Concrete highways defy the poundings of traffic year in and year out. They won't blow away during dry weather, won't wash away in wet weather. Let weather and season change—the road won't—for any day, any season is just the same to a concrete road. It's not what they cost to build but the little they cost to maintain that makes concrete pavements economical.

People know what they want and ask for it—***concrete***—a dollar of value for every dollar that they are so generously investing in improved highways.

PORTLAND CEMENT ASSOCIATION

Atlanta	Detroit	Milwaukee	Salt Lake City
Chicago	Helena	Minneapolis	Seattle
Dallas	Indianapolis	New York	St. Louis
Denver	Kansas City	Parkersburg	Washington
Des Moines	Los Angeles	Pittsburgh	

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL AND PUBLIC WORKS" and "CONTRACTING"

Vol. 48 NEW YORK, FEBRUARY 28, 1920 No. 7

Bridge Arch Center Trusses

By C. D. McArthur

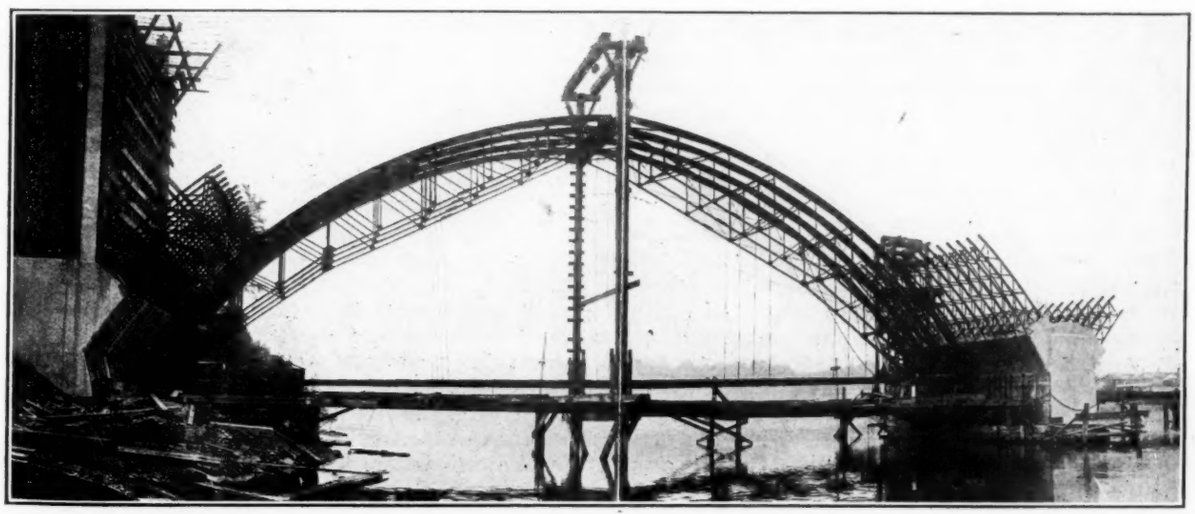
Concrete barrel and rib arches for bridge spans are advantageously carried on falsework truss centers for spans of more than 25 or 30 feet, especially if very high or over spaces where obstructions are objectionable. Steel trusses of standard designs and fabrication are increasingly economical as costs of labor and materials rise. They are especially so for long or multiple spans and heavy loads. They are safer, stiffer, more accurate and reliable and more easily and cheaply handled and have much wider range of dimensions. They can be rented or bought and salvaged.

The bridge arch centers here considered are the full length or long span temporary truss supports used for the construction of masonry or concrete arches and removed after the latter are swung. Arch spans of less than 20 or 25 feet are not considered because they are comparatively few and unimportant, and usually built under conditions that permit any kind of temporary supports to be adopted, utilizing local conditions and materials according to the convenience of the builder without much regard to theoretical consideration or to economical advantages and disadvantages that become important on larger and more numerous structures.

CHARACTER OF ARCH SPANS.

Bridge arches, both for railroad and highway traffic are at present constructed almost always of concrete, usually with reinforcement, although they are occasionally built of stone or of a combination of concrete and paving stone, and very rarely of brick. In any event, they require during construction to be supported on temporary platforms to correspond with the intrados of the arch and are designed to afford strength and rigidity and to be capable of removal in such a way as to transfer the load of the permanent structure to its own elements in a satisfactory manner.

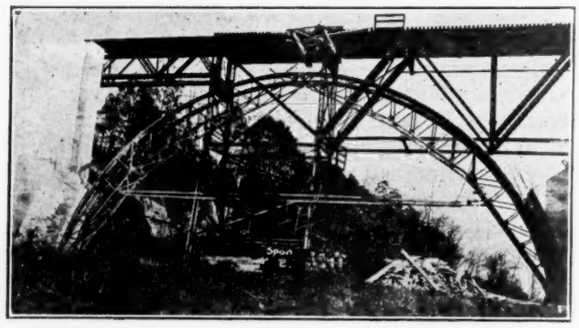
In proportion as the openings become higher



ARCH CENTER TRUSSES ERECTED FOR LONG SPAN OF MENTONNE, N. Y., BRIDGE, AND REINFORCEMENT STEEL ASSEMBLED AT SKEWBACKS.

and wider the difficulty and expense of providing temporary supports for the permanent structure are increased and it generally becomes desirable to use trusses known as centres, to support the lagging on which the elements of the permanent arch are assembled.

Concrete arch spans are of all lengths up to 200 feet with occasional examples up to a practical maximum of 300 feet as is illustrated by the Key bridge now being built at Washington, D. C. Still greater lengths have rarely been designed and a very few have been built but the weight and stresses become so great that each of them is a special problem requiring special treatment and subject to practical consideration that vary greatly with local conditions and eliminate uniformity of practise in the matter of centers.



ROANOKE BRIDGE TRUSS CENTERS ERECTED READY FOR LAGGING.

The general consideration of making the cost of the substructure and superstructure equal in the interests of economy; the requirements for waterways, clearance underneath and grade overhead, together with aesthetic considerations and established precedent, operate to keep the great majority of arch bridge spans in this country between lengths of about 40 feet and 200 feet so that an average of those requiring truss centres are considered to have a span of approximately 120 feet. When the height of the opening is small and it is permissible to obstruct it with falsework and shoring, the span may be supported during construction at so many intermediate points that the use of trusses is unnecessary and cheaper results can be obtained without them. These cases are however comparatively few and will be here ignored, attention being fixed solely on the cases where full length temporary spans are required for construction purposes.

WOODEN TRUSSES.

Where the spans are few and short, and the permanent structure is very light, especially where there is little or no duplication of spans, and perhaps in some cases where moderate length spans have to be constructed in very remote or inaccessible localities; where timber is plentiful and where great delay and expense would be involved in shipping steel trusses; wooden trusses may be preferable for spans up to about 75 feet. They can be built at the site with ordinary tools and mechanics but they are more difficult to design and adjust, are heavier for equal strength, are subject to injury in moving, taking down and re-assembling, are inflammable and may absorb large quantities of water causing them to become swelled and distorted. They are not adapted to very heavy stresses or extremely accurate operations.

STEEL TRUSSES.

Steel trusses are indispensible for very long spans and great weights, and possess many practical and theoretical advantages over wooden trusses for moderate length spans in which the latter might be used.

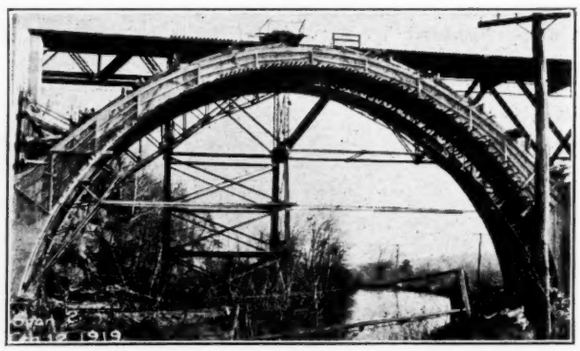
Steel is a much safer and more reliable material than wood and can be designed and fabricated with far greater precision, thus eliminating a large factor of uncertainty and expense. The steel trusses are designed by experts thoroughly familiar with theoretical and practical requirements, are built of standard materials and fabricated in special shops. They are accurately proportioned and properly detailed according to standard structural steel specifications for stresses, materials and workmanship, and are therefore thoroughly reliable without waste or extravagance.

They are really tools of precision, economically designed and applied, and specialized according to the particular requirements of each case.

They are much lighter and stiffer than wooden trusses of equivalent strength; they are more easily handled, assembled and erected; they are not subject to injury or deterioration in shipment, handling or storage; they are more quickly, easily, and safely erected, taken down, re-assembled and shifted; they are adapted for economical and efficient bracing and their use relieves the contractor of any anxiety regarding safety and efficiency.

COMPARATIVE COSTS.

Where the length or the weight of the arch is very great and it is necessary to maintain a clear



FORMS IN POSITION ON STEEL CENTERS FOR ROANOKE BRIDGE.

opening underneath, or on account of flood conditions, there is often no alternative to the steel truss at any price, and even where the use of wooden trusses under such conditions is within the limits of possibility, their cost becomes too excessive for serious consideration.

In almost all other cases where there is a possibility of choice between wood and steel the latter is more economical, regardless of all other advantages, in direct proportion to the re-use that

is practicable. Formerly if a steel truss could be moved and used over again four times, it was assumed to be cheaper than a wooden truss that might cost less initially but would require renewal or repairing and be more difficult to handle. With the present increased cost of timber and labor, it is considered that steel trusses can be used as economically or more so than wood if they can be used only twice.

To accomplish this, it is not necessary that the spans should be exact duplicates because considerable variation of span can be met with the same trusses and inexpensive alterations easily effected. Trusses may also be re-used in the same span when the width of the latter is great and the trusses are shifted transversely during successive stages of construction.

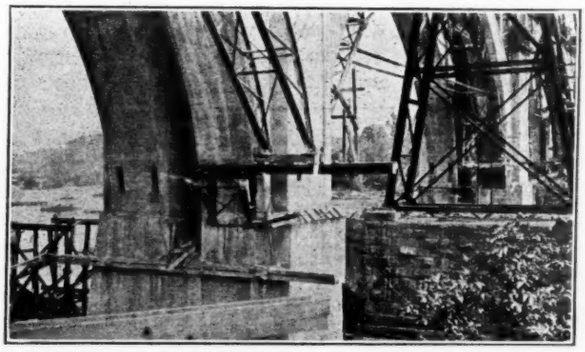
RENTAL AND SALVAGE.

At present steel trusses are generally rented by the manufacturer to the contractor at a price which approximates about $1.50 per yd. of concrete in the bridge superstructure including roadways, spandrel walls and other concrete above the springing line, while the corresponding cost for wooden trusses is estimated at about $4 per cu. yd. of concrete.

The trusses are usually designed especially for the work on which they are used and are then returned to the fabricating shops where there are special facilities for cutting them up into high grade scrap which is stored, sometimes for months, until it can be sold in the most favorable market, whereas, if the contractor purchases the trusses outright, he must either store them for a long time on the possible chance of an opportunity to use them in future work usually involving radical changes in them, or he must sell them for scrap and cannot usually hold them so long or sell them so advantageously as the manufacturer.

DESIGN.

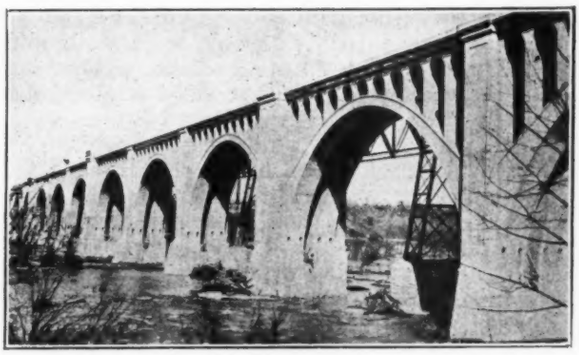
Arch center trusses are of simple design pro-



ROANOKE BRIDGE ARCH CENTER TRUSSES DISPLACED TRANSVERSELY READY FOR LONGITUDINAL MOVEMENT TO NEXT SPAN.

portioned for the maximum dead load of the permanent structure plus all erection stresses, and for the unbalanced erection loads produced by unequal and unsymmetrical loading during construction. They always have top chords curved approximately to fit the intrados of the arch but the outline of the remainder of the truss and the arrangement of the web members may vary to suit special requirements or the fancy of the designer.

A large majority of the trusses, however, are of a standard type, each span being composed of two symmetrical duplicate units connected at the crown of the arch and having the ends of their top chords connected by straight inclined lower chords reaching from crown to skewbacks and intermediately connected to the top chord by radial and inclined members. The lower end of one of these units is connected to the lower end of the



BRIDGE AT ROANOKE, VA., CONCRETED ON STEEL TRUSSED CENTERS.

other by an adjustable horizontal tension member pin-connected to the skewbacks and frequently supported from the crown by a tension member at the middle point. Sometimes these trusses are pin-connected together at the crown of the arch but even if not, the flexibility of construction is such as to generally make it equivalents to a one-hinge arch.

The top and bottom chords have T-shape cross sections made with pairs of angles and vertical web plates. The web members are made with one or two pairs of angles riveted to gusset plates. Trusses 40 feet long or less are generally riveted up complete at the shops and shipped as units. Longer spans are shipped in sections as large as can be advantageously transported and handled by the contractors. With the exception of the pin connections mentioned, all field joints and splices are made with finished bolts in reamed holes and all other joints and connections are shop riveted.

For any span multiple trusses are always required and are generally spaced about 5 feet apart on centres transversely and connected together with vertical transverse bracing and with diagonal laterals, all of which may be either compression or tension members, the latter generally having screw ends or turnbuckle adjustments.

The weights of the spans vary of course according to the dimensions of the permanent arches and single trusses weigh from about 2,000 pounds for a 25-foot span to 130,000 pounds for a 200-foot span, depending entirely upon the load. A maximum weight of a single truss section as shipped from the fabricating shop is about 10,000 pounds.

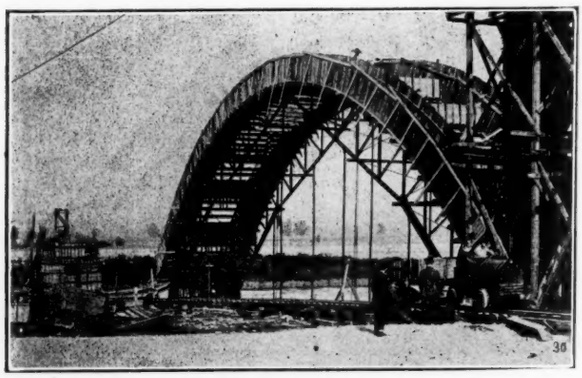
ERECTING AND HANDLING TRUSSES.

Spans up to about 75 feet in length are generally assembled and connected complete in a horizontal plane on the ground, and lifted to their required position by derricks, gin poles, locomotive derricks, cableways, or any other hoisting plant

that the contractor has installed for general construction purposes. Spans of more than 75 feet can generally be erected in two sections handled simultaneously by the derricks or other apparatus that hold them in position until spliced at the field connections making them self supporting. Still longer trusses may be similarly erected in three sections, the end sections being put in position and maintained there while the center section is hoisted and connected to them. As fast as the trusses are erected they should be braced to each other or to some stable objects, or should be carefully guyed until two or more trusses are thoroughly braced together with their transverse and lateral members, making an independently stable structure.

Very long or heavy spans may, if necessary, be erected piecemeal on falsework similar to that for the erection of steel truss bridges, but this method is seldom necessary and then only for extreme dimensions.

In the construction of very wide arch bridges, particularly where they replace old bridges on the same alignment, it is frequently desirable to complete one longitudinal half of the bridge from end to end before commencing the second half, but, if there are only a few good size spans of a new



FALSEWORK TRUSSES SUPPORTING FORMS FOR RIBS AND STRUTS OF BROADWAY BRIDGE OVER ARKANSAS RIVER AT FORT SMITH, ARK.

bridge, it is generally economical to build one longitudinal half of one or two spans and then build the second half of the same span or spans before commencing other spans of the same structure. Steel truss centers are therefore provided for a certain number of semi-spans and may be shifted both transversely and longitudinally as the work advances.

They are usually shifted transversely by moving horizontally the entire group braced together as a single unit for each span. To accomplish this they are lowered sufficiently to clear the intrados of the finished arch and are pushed across on a horizontal track with roller bearings or on greased skids. They may be hauled by tackles at each end, forced over by jacks, or pinched along by hand, or by a combination of these methods.

For longitudinal movements they are generaly stripped of the lagging, transverse bracing and laterals removed, and the trusses if of short or of moderate spans, handled as units from one span to the next, or if larger are disconnected into the original shipping sections which are handled in any convenient manner.

The trusses are provided at the lower ends with shoes or pedestals having horizontal base plates that take bearing, during service, on pairs of folding wedges supported on the piers, abutments, or falsework. They are easily set and adjusted to give them the exact elevation required. The length of span is accurately determined and secured by the adjustments in the bottom chords that usually provide for several inches difference in length with corresponding rise and fall of the top chords.

On important work the trusses are designed to have, when first erected and not loaded, a slightly greater depth than the required rise of the completed arch. The compression of the top chord when fully loaded is sufficient to bring it very closely to the exact curve corresponding to that of the intrados. During construction, while the trusses are partly or unequally loaded or when they are subjected to great inequalities of temperature, as when one is exposed to sunshine and another is in shade, there may be considerable distortion or deflection amounting to an inch or more that disappears with uniform loading and temperature.

When the concrete is sufficiently hardened, the wedges supporting the ends of the trusses are slacked off and adjustments screwed up, springing the trusses so that the bottom chords are easily detached from the concrete and lowered to position for removal or transverse displacement.

Trusses can usually be modified to suit spans a few feet longer or shorter than those for which they were designed, by the simple expedient of lengthening or shortening the end panels which can be generally done by changing a very few members, new ones being supplied if necessary by the manufacturers. If there is any material difference in the curve of the intrados it can generally be provided for by inserting fillers between the curved top chords of the trusses and the lagging. In this way one set of trusses are frequently made to suffice for three different span lengths and are made the exact length for the intermediate span, extended for the longer, and shortened for the smallest one.

Rational Highway Construction

Lewis S. Sadler, State Highway Commissioner of Pennsylvania in a recent address to the York County Commissioners, urged them to pay special attention to heavy hauling in planning their program for the expenditure of $2,500,000 road money. He pointed out that although the absence of trucks might permit a saving of $20,000 a mile on road building, the trucks have come to stay and must be provided for in increasing numbers, and that the roads should be built so as to be serviceable 365 days in the year, and laid out in such a manner that the entire county will benefit rather than individuals. It was also desirable to consider the adequacy of 15-foot roads in some places where travel was light, and very heavy construction may be unnecessary.

Pavement repairs in Boston last year exceeded any previous year and the condition of the streets was such that $10,000,000 could be advantageously spent on them during the next few years.

$200,000 to Advance Construction Organization

Great results possible from the ably developed plans, preparations, resources and official development of the Associated General Contractors of America as a powerful and beneficent national federation of strong and reputable individuals and associations responsible for a large proportion of public construction in this country.

The strong progressive action of the Associated General Contractors of America at their annual meeting in Chicago last week, is an index of the attitude of large construction interests in this country and the readiness with which the individuals associated with them, devote their time, labor and money to improvements and organization that tend to develop and safeguard engineering construction throughout this whole country. Members present subscribed $200,000 in less than one hour, for promoting the great aims of this splendid engine of national prosperity. The magnitude and purpose of their efforts are best set forth in the preamble to their constitution which was adopted as an amendment as follows:

The special aims of this Association are:

(a) To make membership in the Association a reasonable assurance to the public of the skill, honesty and responsibility of its members, by requiring that those admitted to membership shall have established an honorable reputation on these three fundamental points, and by making continuance in this membership depend upon fair dealings between members and between members and the public.

(b) To provide methods and means whereby members may avail themselves of the greater power of combined effort through the Association, acting as an authoritative body, in demanding and securing just and honorable dealings from the public whom they serve.

(c) To secure uniformity of action among the individuals forming the Association upon the general principles herein set forth, and upon such other principles as may be decided upon, from time to time, as best for the good of the industry as a whole.

Other amendment classify the membership and fix a sliding scale of views differentiated according to the nature and amount of business executed.

ARTICLE III—MEMBERSHIP.

Section I. Membership in the Associated General Contractors of America may be of three classes: (1) Individual, (2) Associated Organization, (3) Honorary.

Section 2. Only General Contractors, either individuals, firms or corporations, who have been engaged for at least two (2) years in general contracting, prior to applying for membership in this Association and who have established a reputation for skill, honesty, and responsibility, shall be eligible for individual membership. They must also undertake work in its entirety partly, at least, with their own constructing forces.

Section 3. Only organizations of General Contractors shall be eligible to membership as Associated Organizations. Only such members of Associated Organizations as fullfill the above requirements for individual membership shall have voting representation in this Association.

Section 4. The Executive Board may elect as Honorary Members individuals, firms or corporations, who have executed some unusual and exceptional construction work or who have performed distinguished service for the nation or for this Association, whom the Association shall deem worthy of the distinction. Honorary members shall be exempt from assessments of dues.

ARTICLE VI.—DUES.

Section 1. The dues of the Association shall be for each individual, firm or corporation, as follows:

	Members Whose Business in the Previous Year Exceeded	But Was Less Than	Dues per Annum
Class A	$2,000,000	$.....	$250.00
Class B	1,000,000	2,000,000	150.00
Class C	500,000	1,000,000	100.00
Class D	250,000	500,000	50.00
Class E	.....	250,000	25.00

Section 2. The dues of Associated Organizations shall be twenty per cent (20%) of their annual income from dues with a minimum payment of twenty-five dollars ($25.00) and a maximum payment of one hundred dollars ($100.00) for each one of their individual, firm or corporation members.

Another important amendment provides for the enlargement of the Executive Board to consist of president, three vice-presidents, a treasurer, 12 directors and the three living past presidents most recently elected.

An Advisory Board of seven members was created that consists of the retiring officers and directors and such others (not necessarily members) as may be selected by the Board. Members of the Advisory Board shall act as alternates at the meetings of the Board in the absence of Directors, only, however, when they are members of the Associated General Contractors of America. They shall hold office for one year.

The by-laws provide that there shall be created Members' Divisions, each of which shall be devoted to the promotion of the interests of a special type of construction. Each division shall have its own Chairman and Vice-Chairman and such Special Committees as are necessary. Action taken by any Division to be official must be approved by the Executive Board.

There shall be created a Building Contractors'

Division of the Associated General Contractors.

There shall be created a Highway Contractors' Division of the Associated General Contractors.

There shall be created a Railroad Contractors' Division of the Associated General Contractors.

There shall be created a Public Works Division of the Associated General Contractors.

Provision was also made for sixteen important standing committees, namely, executive.

The standing Committees of the Association shall be:

Executive	Legislative	Ethics	Publicity
Finance	Labor	Construction	Development
Auditing	Methods	Annual Convention	
Nominating	Contracts	Transportation	
Membership	Codes	Insurance and Bonds.	

Subjects for investigation and report by any of the Committees may be recommended by any member of the Association to the Board, to the Chairman of any Committee, or to the Secretary who shall refer them to the Board. The Board shall then refer them to the proper committee for investigation and report with recommendations. Ordinarily action following investigation and report shall not be taken by any committee without the approval of the Board; and no action taken by any committee shall be official without such approval, thus insuring deliberate action.

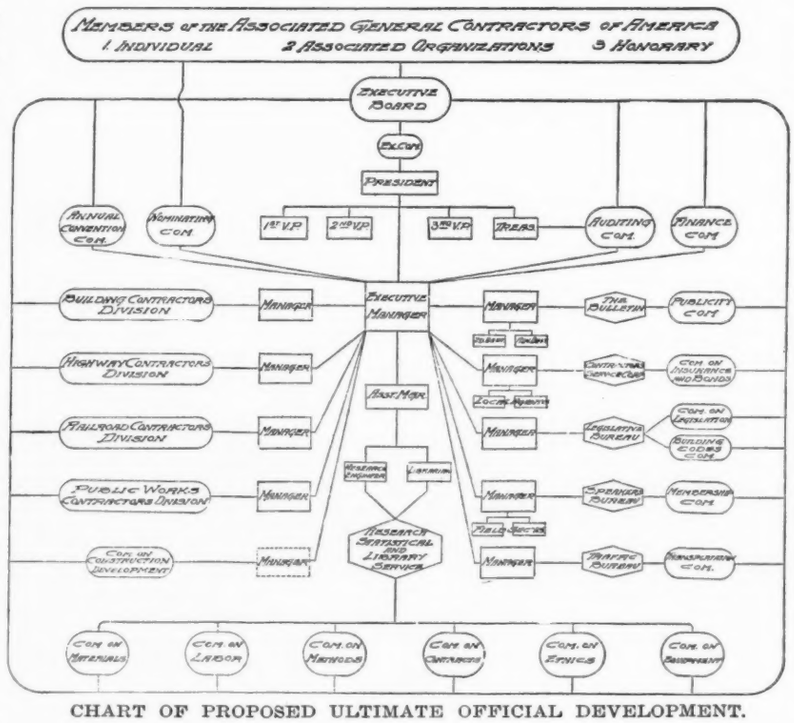


CHART OF PROPOSED ULTIMATE OFFICIAL DEVELOPMENT.

The duties of most of the committees are evident from their names. The Legislative Committee shall have charge of the legislative program of the Association, both state and national. It shall see that legislation of interest to general contractors is refered to the proper committee for investigation and report or investigate and report thereon itself. It shall have general charge of the Legislative Service hereinafter described.

The Committee on Construction Development shall have charge of promoting the best interests of building, highway, railroad, public works and other types of construction work. It shall have general supervision of the organization of the members of the Association in Divisions representing these types of construction to promote the special interests of these special fields as hereinafter described.

Provision is made for a corporation, owned by the association to act as agents for members of the association and other contractors in placing insurance and surety bonds. Another corporation, owned by the association, is authorized to publish a weekly or monthly magazine or news letter or both.

Other activities of the association are promoted by the special services authorized with headquarters at Washington to co-operate with the Legislative Committee in its work in keeping members informed regarding national and state legislation. The selection of a manager, counsel and other assistants shal be made by the Secretary with the approval of the Board.

A Library Service or Construction Index, which shall keep the Committees and all members informed regarding matters of interest to general contractors which are presented in current periodicals, bulletins, govenment reports, and other publications, shall be created to co-operate with the Executive Committee and the Secretary in their work with all the Committees.

A Personal Service which shall act as an exchange of information among members regarding men available for employment or positions open for men, and as a means of aiding members to find suitable men for their organizations, shall be created to co-operate with the Committee on Labor in its work.

A Surplus Equipment Service, which shall act as an exchange of information among members regarding equipment for sale or for rent and which shall aid members in securing proper equipment, shall be created to co-operate with the Committee on Methods in its work.

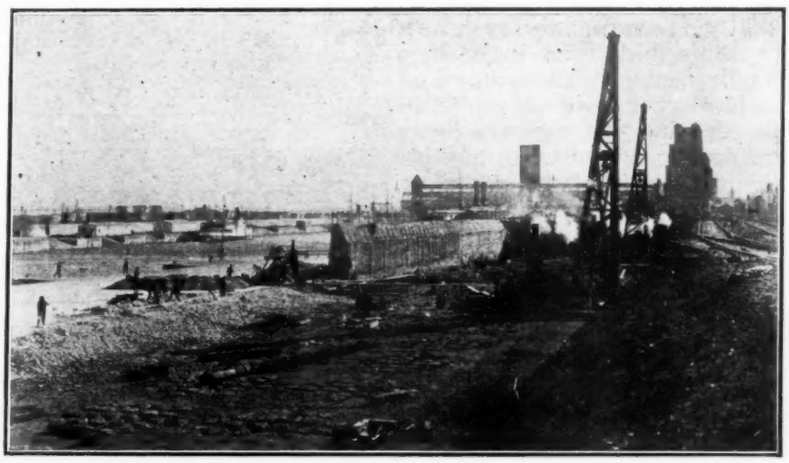
These changes and provisions have resulted from the tentative operations and the efforts and experiences of the officers and members of the society during the year that has elapsed since the business organizations were commenced. The co-ordination of the members, officials, and operations of the association are graphically indicated in the accompanying diagram which was presented as a working basis for the practical and rational organization of general contractors of all kinds. By a temporary combination of some of the different activities under single officials, it is believed that the plan can be adapted for the present requirements of the association and still provide for future expansion, great efficiency of operation, and advantage of members.

Water-front Foundation in Montreal

Driving and testing piles to carry a load of forty tons each along the river front of Montreal. About three thousand were driven by steam hammer in three and a half months.

The harbor commissioners of Montreal, Canada, having decided to build a large cold storage plant on the shore of the St. Lawrence river, found it necessary to support this plant on approximately 3,000 foundation piles, each to carry a working load of forty tons. The site of the plant was covered with a sand fill twelve to eighteen feet deep, and the commissioners considered it essential that the piles be driven entirely through this fill and penetrate the original ground beneath.

In order to insure that this supporting capacity would be obtained, the commissioners invited several pile companies to drive sample piles on the site at their own expense. Only one company consented to do this, and drove pile cores until the penetration under five blows of a Number 1 Vulcan steam hammer did not exceed one inch. Even under this heavy driving the piles failed to penetrate the stratum below the fill, and the commissioners declined to adopt this type of pile for the structure.



TWO OF THREE LAND MACHINES BY WHICH 3,000 PILES WERE DRIVEN IN 107 DAYS.

Finally arrangement was made with another company, the MacArthur Concrete Pile and Foundation Company, whereby it agreed to drive piles to a refusal of one inch for fifteen blows of a Number 1 Vulcan steam hammer, which the company believed would suffice to drive the majority of piles through the fill; to drive 750 linear feet of piles per day; and to guarantee that, if they did not pass entirely through the fill, it was because the fill was so compacted that this would be unnecessary. As a matter of fact, nearly all the piles were driven through the fill, some being subjected to thirty blows per inch of penetration, and some reached a maximum penetration of fourteen feet below the bottom of the fill, the average penetration below the fill being four feet. The guarantee of 750 linear feet of piles per day was exceeded by more than fifty per cent.

CONSTRUCTING THE PILES.

The piles used were those known as "pedestal piles," formed by driving a steel core and shell, then removing the core and filling the shell with concrete. For driving the piles the contractor used three wooden pile-driving towers with leads sixty feet high, equipped with a 6,000 pound Number 1 Vulcan steam hammer; hammer and tower combined weighing about twenty tons. One ½-yard Ransome and one 1/3-yard Smith steam driven concrete mixers were used for filling the pile shells, the concrete being placed by special one-half yard buckets. Cores and shells were used up to forty feet long.

The pile driver towers were assembled in position lying horizontal on the ground and were revolved into vertical position by tackles passing over tripping bents and operated by a hoisting engine. When erect, they were mounted on rollers of 16-inch pipe with solid cores which were placed between the bottom frame and the track sills: The steam-operated hoisting engine, which raised and lowered the hammer and provided the steam to operate it, also operated a tackle by which the tower was pulled forward on the rollers or skidded sideways on them, it requiring not more than one minute to set the machine in position for driving a new pile after the previous one had been finished.

The core was a steel pipe furnished with a shoulder near the top which rested on the top of the 16-inch steel shell, the top of the core projecting twelve inches above the shell and containing an oak driving block. The shell with the core in it was driven to one inch refusal under fifteen to thirty blows; the core was then removed and the shell filled with concrete by means of the special bucket referred to above, the bucket depositing about six cubic feet of 1:2 ½:5 concrete each time. After each charge of concrete, the core was replaced and operated upon by the hammer so as to compact the concrete. After each charge of concrete, the shell was raised about two feet, so that

the concrete was driven into the surrounding ground, and it was calculated that the resulting pedestal had an average diameter of about 2½ feet, whereas the shell was only 16 inches in diameter. The tops of the piles were finished flush with the surface of the ground.

The driving of the 3,000 piles was completed in 107 days total elapsed time. The working force averaged about sixty men, who made a daily average of 54 piles with the three machines, the maximum record of any one machine being 32 piles. These piles averaged nineteen feet in length. The total amount of concrete used was about 3,600 yards.

TEST OF PILES.

In order to ascertain the condition and efficiency of the piles, an excavation was made which uncovered four of the piles to their extreme bottoms, and one of the piles was subjected to a test load of sixty-five tons. This load produced a vertical displacement of only ⅛ inch, and this was due to compression and not to settlement, since the pile head returned to its original position with the removal of the load.

In excavating down to the bottoms of the four piles, it was noticed that the driving had produced, for about twelve inches horizontally, a slight vertical displacement in the horizontal stratification of the filled-in soil, which fill had been deposited in definite layers about twelve inches thick, when it had been made by the hydraulic method. These strata all curved downward a few inches tangentially with the surface of the pile, showing that the very heavy frictional resistance developed in driving, together with some possible displacement of the soil below, had set up a definite movement in the earth and caused it to pack very firmly around the surface of the pile.

Cost-Plus Contracts Authorized

The Public Works Commission, Newark, N. J., has authorized the preparation of an amendment to the sewerage act empowering contracts to be made on the cost plus basis.

Improvement certificates from municipalities in the district are not acceptable to the commission as payment for the costs of sewerage construtcion. There is no authority either in the statute or the contracts which authorizes the acceptance of anything but cash. If the certificates could be negotiated without the commission assuming any liability the amount received might be credited.

The United Traction Company will be permitted to charge a trolley fare of 7 cents in Albany and Rensselaer, under a decision handed down by the New York State Public Service Commission, Second District. The order will become effective within five days after the company files its schedule of rates with the commission and will be operative for one year.

Municipal disposal of household garbage and waste is strongley urged by Dr. Paul R. Hoppe, who is leading a series of discussions at the Y. M. C. A. Fellowship Club meeting, on a theme "Practical Social Christianity" and thinks municipalities should get busy in matters of sanitation and housing.

$20,000,000 Inland Waterway Improvement

Frank C. Lowden, governor of Illinois, has received from the secretary of war a permit for the construction of the Illinois waterway, which will connect and make serviceable for water-borne commerce 15,000 miles of inland rivers in the middle west. The project embraces the improvement of the Desplaines and Illinois rivers.

Direct water route between Chicago and New Orleans and from the lakes to St. Paul and Minneapolis are established by the permit and when completed it will also open water connection with Pittsburgh and Ohio river points.

The cost of the work is estimated at $20,000,000. Locks will be 600 feet long and 110 feet wide, accommodating fleets of barge boats carrying from 6,000 to 8,000 tons of freight.

Street Snow Excavation by Power

A method of power excavation for snow is reported to be in use in some Canadian cities at a cost of $35.70 per thousand cubic yard, thus effecting an economy of $18.10 or nearly thirty-four per cent of the estimated cost of $53.80 per thousand cubic yards removed by hand shovelling.

The machine has a revolving cutter head driven by a 60-horse power gasoline engine mounted on a steel frame and sled and makes a cut 5½ feet wide, distributing the snow in a uniform horizontal layer at a distance of from 3 feet to 15 feet from the machine as desired. The initial cut is widened by trimming the sides with repeated operations of the machine. The machine can be drawn by a tractor or by from four to six horses, and will operate in snow up to 6 feet deep. It excavates the snow to within 6 inches of the surface of the ground thus leaving a sufficient bed for sleighing.

Such a machine would appear to be very useful for opening up traffic where there is sufficient room in the street to permit the snow to remain adjacent to the track, but where the snow must be removed the expense would of course be greatly increased by rehandling it to trucks or sleighs for removal.

Big Hydro Plant for China

China is planning to build the largest hydro-electric plant in the world, according to Jen Chow, a former Cornell man, who arrived here recently from the Orient to purchase machinery and supplies for the Chengtu Light and Power Company, as well as to study hydro-electrical development in the United States.

The plant will be built in the Province of Szechuan, making use of the enormous power, hitherto wasted, of the Yangtse rapids.

The report of George D. Craft, New York State Conservation Commissioner, urges the importance of conserving the state water power and that the state should construct dams and reservoirs on many streams in order to store spring freshets for the use during the summer drouth. Provision should be promptly made to stop the waste of the Niagara and St. Lawrence rivers and along the barge canal.

PUBLIC WORKS

Published Weekly at
243 West 39th Street, New York, N. Y.
by
Municipal Journal and Engineer, Inc.

Subscription Rates

United States and Possessions, Mexico and Cuba....$3.00 per year
All other countries .....$4.00 per year
Entered as second-class matter January 3, 1906, at the Post Office at New York, N. Y., under the Act of Congress of March 3, 1879.

Change of Address

Subscribers are requested to notify us promptly of change of address, giving both old and new addresses.

Telephone (New York): Bryant 9591
Western Office: Monadnock Block, Chicago

A. PRESCOTT FOLWELL, *Editor*
FRANK W. SKINNER, *Associate Editor*

False Work for Concrete Arch Bridges

Within a few years the construction of concrete arch bridge spans has so greatly increased that the practical methods and appliances have become of great importance and certain fundamental requisites have been substantially standardized so that general practice closely follows well defined lines that make for a general maximum of efficiency, rapidity, safety and economy.

The advantages of concrete arch spans have over ordinary steel construction in durability, in excess strength, in rigidity, in freedom from maintenance charges, in the elimination of transported materials and costly fabrication, and in the adaptation to artistic treatment have outweighed increased initial costs and have caused their adaptation in rapidly increasing proportion both for railroad and highway strnctures. The unprecedented amount of present and future highway construction add greatly to the large volume of arch span business.

In the construction of moderate-to-large spans, there is no feature likely to be more important and often troublesome than the proper support of the spans during construction, before the concrete becomes self-sustaining. At times it imposes excessive unbalanced loads on supports which must be very accurate and stable, must be capable of precise adjustment and should be easily installed and removed. These requirements are often difficult of attainment, especially for large and high spans. A large proportion of the cost of the work may often depend on the question of falsework and concrete supports the essential features of which are authoritatively treated on page 139 by the chief engineer of a notable organization that has for years been identified with the largest interests and most substantial development of these features.

Fixed Traffic Signals

During the past few years there have been constructed in all parts of the country, in both cities and suburban districts, permanent posts or standards carrying signs for the direction of traffic. These are especially frequent at the intersections of highways, for the purpose of requiring traffic to turn around the post and avoid short cuts across the corners. Many of these are of concrete or, in some cases, of cast iron, and would undoubtedly cause serious damage to a vehicle running into one of them at high speed. There have been a number of such accidents in cities, even where the post has carried a light, and the question arises, to what extent the city or other authority in control of the road is liable for such accidents.

This question is discussed in this issue by John Simpson. Mr. Simpson reports that he has not found any decisions applying particularly to traffic signs or posts, but that the general principles which apply to other obstructions would cover these also. No effort was made to discuss, in this article, decisions dealing with depressions, piles of building material, or anything other than *fixed* obstructions.

The general trend of the opinions appears to be that a city is not liable for accidents caused by running into obstructions in the highways where such obstructions serve a public purpose and have been located and maintained with reasonable care by the public authorities. Also, at least one decision appears to indicate that the authorities are not justified in creating such obstruction, if a reasonable amount of forethought and care would have enabled them to obtain the same result without endangering traffic.

As in most cases of similar nature, what the outcome of a suit for damages in any particular case would be, will depend largely upon the decision of the court and the jury as to the reasonableness and care which have been employed in connection with the particular obstruction involved in that case. Officials who are wise and who have consideration for the safety of the traveling public will not endeavor to steer as close as possible to the border between liability and non-liability, but will use not only reasonable, but an excess of care in deciding upon the kind and location of the traffic signals which they place in the highways, with a view to minimizing the danger of accidents therefrom.

Public Fuel and Power Station

The suffering in this country from a shortage of fuel and power has been considerable and the menace of increasing future scarcity and uncertainty is great, especially in large cities. The great concentration in congested areas, the rapidly increasing developments and distribution of power, and the universal reliance on public utilities for transportation, light, water, and for a large amount of heat in large cities, have almost eliminated individual resources in these matters, and have made the population 100 per cent dependent on public supplies. The reduction or serious interruption of these supplies is an enormous menace to safety, comfort and prosperity.

This danger has been demonstrated with increasing frequency of late. The natural causes, like storms, floods, severe cold and other physical conditions that operate adversely have been enormously increased by wilful and malicious political, industrial and social factors, chief among which have been labor profiteering and inefficiency. Unveiled threats against the life of the country have gone practically unrebuked and unresisted and it is time that efficient measures are vigorously taken, at no matter what cost, to protect the public.

Obviously the difficulty, waste and expense in

securing, storing, and using fuel and in the development and distribution of light, heat and power increase proportionately with the sub-division and scattering of these units that involve a multiplicity of expensive branches, duplication of plants, increase of supplies, decrease of efficiency and enormous multiplication of labor, organization, and attendance. These all becoming more and more serious in geometrical ratio as the size and density of the districts and amount of fuel required increase.

A very sensible, rational suggestion has been made by Edwin Ludlow, consulting engineer and former vice-president of the Lehigh Coal & Navigation Co., who proposes that an enormous coal storage plant be installed on the unimproved and comparatively cheap Newark meadows, to provide a large reserve for the New York Metropolitan District, and that there also be established there a great central electrical power plant that could give independent service and supplement the existing plants. The site is admirably located, accessible to all railroads entering New York City and with available deep water front that makes it as nearly as possible immune from transportation blockades and congestion, and the territory is now unoccupied so that no unreasonable prices should be involved in its purchase. The feasibility of extraordinarily large storage and power plants may require further investigation and able expert study is of course necessary for even a preliminary formulation of the character and details of the proposed installation. The potential value of this scheme is so great and its importance as a public insurance is so evident that no time should be lost in a preliminary investigation by authorized experts. The results will be closely watched by all of our great cities, especially those on the seaboard.

Uplift of Engineering Construction

The political military, and financial necessities of the last few years that necessarily subordinated everything to winning the war, bore most heavily on the construction of all sorts of public works and other engineering schemes which to a large extent, were classified as non-essential and where not intrinsically impossible of execution, were generally discouraged and often prohibited. The succeeding period of unrest, uncertainty, diminished resources and production and extortionate prices have also been most demoralizing and injurious to great construction interests.

The prominent contractors who have been, are, and always will be, to a great extent, the builders of public works, realizing this condition, organized in the Fall of 1918 a great national society called the Associated General Contractors of America, with a strong membership highly representative of the ablest, most experienced and honorable men from every part of this country who were enthusiastically inspired with altruistic purpose to benefit the construction industry, the largest and most important in this country, that normally handles several billions of dollars of work each year.

It was the purpose of this organization to assist and inspire individuals, encourage local, municipal, state, and sectional construction organizations; to weld them all into one powerful central federation fitted to co-operate most efficiently with engineers, architects, public officials and other owners; to consolidate scattering efforts and direct them in the most efficient manner; to establish high standards; maintain friendly relations with business, political, social, industrial and financial interests; avoid repetition and conflict; and in general, to handle large issues and national questions from headquarters, leaving local and personal matters to the individual members or societies who would at the same time be able to avail themselves of the advantages of the main organization.

The association, starting with a splendid impetus, has been conservatively managed and its officers have carefully and persistently studied, investigated, and tentatively advanced until they have been able to formulate a sound plan providing for progress and development, as outlined on page 133 that promise to be of great importance in the execution of public works of all sorts, and which should receive the careful attention and hearty co-operation of owners, officials, and professional men affiliated with these interests.

The remarkable vigor with which the initial organization was accomplished has been conserved and increased astonishingly, developing a loyalty and enthusiasm that are so universal that the subscription of $200,000 for development and extension was accomplished in a few minutes. An organization having nation-wide membership of men able and eager to do this for high ideals can not fail to go far and high.

Adapting Quality to Requirements

In this period of extreme high prices and reduced production, the use of unnecessarily good materials or labor is an economic crime only less than that of using too poor materials or labor. Architects and engineers have very generally fallen into the habit of making a universal requirement for all materials to be of first quality only, entirely free from blemishes, imperfections, and any kind of fault. With an unfair or ignorant engineer, architect or owner or with an incompetent inspector, such specifications may produce great delay and damage without any resulting good when the letter of the specification is strictly adhered to without regard to conditions. Of course in many cases a broad gage, competent engineer or inspector will overlook many nominal imperfections or unimportant defects where they will not impair the strength or appearance of the structure. Specifications should only require strictly first-class materials or excessively painstaking work where they are really necessary, and should use discretion in accepting inferior grades where they will equally well serve all practical requirements and insure thoroughly satisfactory results. Such a course will expedite the work, reduce its cost and benefit both owner and contractor. Consideration and legitimate concessions to the contractor are appreciated by him and repaid in kind. Contractors can often advantageously suggest revision of specifications along these lines.

Constructing Roads for Motor Truck Traffic*

By T. R. AGG, Prof. of Highways Engineering, Ames, Iowa

Types of Roads Should be Developed With Improved Surfaces, Economic Considerations, Equitable Financing, Standard and Progressive Practice. Cost Should be Divided Between Local and Regional Assessments and Vehicle Taxation. Addition Data of Maximum Vehicle loads, the Supporting Power of Soils, and of Grade and Alignment are Essential to Good Design. Shorter, Wider, and Safer Roads are Being Developed. Maintenance is Greatly Benefited by Efficient Patrol Service.

Up to the present time the most important use of the motor truck outside of the cities has been as a supplement to rail transportation, the vehicles operating on routes paralleling the rail lines. The extent to which this will be profitable in times of normal rail facilities will depend upon many factors, one of which is the availability of paved highways of low tractive resistance and economical grades. The other factors are of an economic character and need not be discussed herein.

INDEPENDENT ROADS

Another important field for motor trucks is on transportation routes that open up territory or connect terminals not served by direct rail connections. Too little attention has generally been given to this possibility in laying out systems of state and county highways for improvement, in that too small a mileage of roads of this class have been provided.

Finally, motor transport will be employed for farm-to-market traffic on a vastly greater scale than at present. In this use the truck will to a great extent supplant the horse and the land now given over to supporting draft animals will produce human food which will all be needed. In very many states, especially those that are agriculturally productive, this development of traffic awaits only the building of suitable highways.

The continued successful utilization of motor transport for any purpose must depend upon ultimate economy and this factor will be influenced very largely by the type and location of the highways constructed and the condition of serviceability in which they are maintained.

In a broad sense, the construction of roads for motor truck traffic involves the adopting of types of improved surfaces, based on appropriate economic considerations, financing by methods that will distribute the costs in an equitable manner and accomplishing the actual construction in accordance with accepted practice in highway engineering, so far as practice has become standard, and blazing the trail wherever research and experience indicate the possibility of improved methods.

* Excerpt of paper presented at American Road Builders Annual Convention, Louisville, Ky., Feb. 9-13.

The financing of extensive surfacing projects involves very large sums of money, and conditions during the past few years have been favorable to highway financing so that comparatively little difficulty is experienced in obtaining money for road improvement. Looking to the future, however, it must be apparent that the completion of the projects now in contemplation in the United States will involve such enormous sums of money that a foundation of sane financing must be laid at the earliest possible moment. This is particularly true now that it is so generally recognized that an appreciable percentage of the highways of the nation must be constructed of such a character that they will be adequate for motor transport, of both high speed passenger vehicles and slower speed, heavy freight vehicles. Construction of this character is costly, although the cost is probably far below the actual benefit to the communities traversed.

It is believed that a system of financing that is in a general way based on distribution of cost according to benefits is justifiable and will be proof against claims of unjust discrimination in taxation for road improvement. The almost insurmountable difficulty lies in devising a means for determining where the benefits fall or the extent of the benefit.

LOCAL AND GENERAL ASSESSMENTS.

The construction in any community of adequate highways of year-around serviceability for motor transport, confers a real benefit on that community. A part of the cost of such an improvement might therefore properly and equitably be paid from general taxation in the district served. But the possibility of the district profitably utilizing the facility will vary greatly with the nature of the industries in the district and it is doubtful if any fixed percentage to be assessed as a general tax would be suitable for an area even as large as a state. Differences in assessed valuation of land would however tend to equalize taxation to a great extent even though the rate of taxation is uniform.

There is also a direct and tangible benefit conferred on agricultural land by the construction of improved roads contiguous thereto. Therefore a certain part of the cost of durable improvements

can rationally and fairly be assessed against such lands. The percentage of the cost to be so assessed is not easily determined, but certainly should not in many cases exceed 25 per cent of the total cost.

TAXING MOTOR CARS.

It probably will be admitted that the most apparent and tangible benefit from road improvement accrues to those who actually travel the highways for business or pleasure and since about 95 per cent of the tonnage on the nation's highways is made of various classes of motor vehicles, it follows that to them the benefit of improved roads is most apparent. The costs for fuel, for vehicle upkeep and the saving in time on improved roads are real and measurable benefits.

Some tests of a preliminary nature were made at Ames to determine the difference in gasoline consumption on various types of surface. While these were too few in number to be conclusive, they indicated 20 per cent as the possible saving between an average earth or gravel road and a high class paved surface. This would mean a saving on motor operation in Iowa of upwards of $3,000,000 a year. It is equitable to require the owners of motor vehicles to contribute somewhat to the cost of the improvement of the highways and very largely to the cost of maintenance. This has been recognized in recent legislation in several states.

The amount that is added to the cost of a road because it must accommodate motor truck traffic can hardly be taxed against others than owners of motor trucks, and it would seem probable that in the future both trucks and passenger vehicles will be required to bear an increasing portion of the cost of road construction and maintenance.

In the whole problem of highway finance, it is necessary to recognize that a roadway is being provided as a transportation facility that is not operated for direct income and the incentive to keep accurate account of the use of the facility in order to place the cost where the benefit is realized is lacking. Nevertheless, the great highway system desired by all progressive citizens can never be fully completed and maintained unless the financing is placed on a sound economic basis.

NECESSARY DESIGN DATA.

In the design of highways for motor transport the engineer is confronted with a problem for which he lacks some of the fundamental data for a complete solution. To begin with, he cannot predict with any assurance the size or weight of the vehicle for which he must provide, yet it is essential to an adequate design to know the maximum load for which provisions must be made. It is for that reason that steps are being taken, looking toward legal standards for the size and weight of motor vehicles.

Neither does the engineer know a great deal about the supporting power of soils under road slabs or the structural strength of road slabs of various designs. In these matters experience affords some guide to the establishment of the proper design, but refinements of design that would lower the first cost, are entirely within the range of possibility. In this field some investigations of great value have been completed, but much additional information is greatly needed.

In the field of railway engineering the relation between grade and curvature of the line and the cost of operation is fully established and when the tonnage of traffic is known, the justifiable expenditure for lowering grades or eliminating curvature can be computed. In the highway field no such data have as yet been obtained, and the design of grades and alignment of highways for motor transport is necessarily based on unsubstantiated assumptions.

WIDTH OF ROAD.

The standard double track width has been increased from 14 feet, the common width a few years ago, to 18 or 20 feet. The allowance per line of traffic has been increased from 8 feet to 9 feet. The width provisions have become more liberal in that almost no single track roads are being considered for the main routes of travel, and near populous centers many sections of three track road have been built.

ALIGNMENT.

Recognition is being given to the desirability of furnishing direct routes and shortening distances wherever possible. Pleasure traffic is not so much benefited by this as is business traffic. On busy routes a saving of a mile in traveled distance between towns, represents in a year a very appreciable saving in time and in operating cost for the vehicle.

Safety considerations have also entered into the design to a marked degree and dangerous sections of road are being eliminated by relocations or by extensive grading. The elimination of short radius curves and the superelevation of the paved surface on the curve are additional safety precautions that are being generally adopted. A great many railway grade crossings are being eliminated and where that is impossible, suitable warning signs are being posted. Guard rails for protection on fills are standard for main highways.

SURFACING.

The lessons of the past few years relative to the disastrous results that follow covering up poorly drained subgrade have been unmistakable. It seems now to be recognized that even a rigid pavement cannot give maximum serviceability when placed on a poorly prepared earth subgrade. The trend is therefore toward much more extensive and costly drainage work preliminary to the surfacing, but it is believed that money so expended adds very materially to the useful life of the wearing surface and is a justifiable expenditure.

In addition to the added care in the preparation of the earth foundation, heavier road slabs are being employed in many states and it is believed that this tendency is in the right direction. Wherever it is likely that truck traffic will develop, and apparently that is wherever roads are provided that will accommodate truck traffic, the accumulated experience of the past five years points clearly to the ultimate economy of heavy slabs.

Increasing attention is being paid to securing surfaces that are smooth, with a view to minimizing the effect of the impact of heavy loads. If

the road surface is even slightly uneven disastrous pounding occurs when the truck travels at normal speed. This is a cause of rapid deterioration to both truck and road surface. As time passes it may be expected that the speed of freight vehicles will increase and while pneumatic tires will do a great deal to minimize impact, every reasonable precaution must be taken to secure smoothness of wearing surface.

MAINTENANCE.

A very general recognition is being given to the necessity for effective maintenance. No matter how admirable may have been the construction, a road surface subjected to motor truck traffic will not give a maximum of serviceability unless systematic and timely maintenance is provided. It will bear constant reiteration that nowhere is the old adage, "A stitch in time saves nine," more applicable than in highway maintenance. Patrol systems and the gang method have been developed to a high state of efficiency and the high degree of serviceability of a new road is maintained without marked depreciation for long periods of time. Timely maintenance if carried out persistently for a period of years probably costs less than spasmodic efforts to make repairs at irregular intervals and certainly continuous maintenance results in the greatest average serviceability.

Building Germantown Dam for 10 Cents Per Yard

The Germantown Dam in the Miami Conservancy District contains 865,000 yards of earth, and has slopes varying from 1 on 4 to 1 on 2 exclusive of the toe apron of 1 on 10. Most of the earth for the embankment is derived from a borrow pit occupying the full width of the adjacent valley where it is excavated by a dragline machine delivering to dump cars that haul to a storage bank at the foot of which is a sump provided with water supply and equipped with a 15-inch centrifugal dredge pump operated by a 400 h. p. electric motor that forces the mud and water into a basin formed in the heart of the dam by boulders and gravel depoited on the slopes.

The waste overflows and the residue packs to form a very solid fill. As the capacity of the dredge pump exceeded that of the dragline, additional material for this dam has been provided by excavating in the adpjacent side hill with a hydraulic monitor that is operated about 13 hours per day and washes 500 yards of clayey material into the sump whence it is pumped to the dam together with about 1,500 yards of bucket material provided by the dragline in two 10 hour shifts.

Gauge readings taken before and after the installation of the hillside excavator show no difference on the pressure head of the dredge pump which is thus able to carry 2,000 yards per day at the same cost that it previously carried 1,500 yards. Taking into account all expenses of installation and operating of the sluicing plant, the estimated cost of depositing hillside material in the dam is from 10 to 12 cents per yard. Materials are fed to the dredge pump through a revolving screen that has greatly increased the efficiency of the pump and enabled it to deliver 50,600 yards of earth to the embankment in the month of August.

The monitor installed for the hillside excavation is supplied with water by two centrifugal pumps and is operated to first undermine the face of the borrow pit until the bank falls down when it is washed into a trench by a stream of water provided by a third pump and is conveyed down the slope to the hog box or sump whence it is delivered to the dam by the dredge pump.

The dam is designed and constructed by the Miami Conservancy District, Arthur E. Morgan, chief engineer; Charles H. Paul, assistant chief engineer. The hydraulic fill operations here noted were illustrated and described in the Miami Conservancy Bulletin.

Newark Investigating Its Sewer Construction

In response to a communication from the City Commissioner of Newark, reciting that Director of Streets and Public Improvements Raymond had been authorized to conduct an investigation to determine the cause of delay in constructing the sewerage system, the Passaic Valley Sewerage Commissioners recently adopted a resolution declaring that "the books and records of this commission are always open to public inspection and that it and its engineers will cheerfully offer every facility" to the engineers appointed by the director to investigate the work of the commissioners.

Director Raymond also notified the commissioners that he had named Clyde Potts and C. C. Vermeule as engineers to make the investigation in connection with engineers of his department.

The engineers have been instructed to make a thorough technical and business-like investigation in order that the taxpayers may be satisfied that their money is being properly spent. Mr .Raymond says:

"From my personal point of view it seems to me that nine years was ample time in which to complete a public improvement such as this sewer, and that the people should be receiving the benefit of the $8,915,000 which has already been paid by them for this project."

Eight construction camps have been established. Two hundred and fifty men and more than 500 horses and mules are used. Construction contracts were signed last November.

Although engineers were retained only last August, construction has been forced so successfully that the system will be ready for use next April, the contract delivery date.

J. F. Mallon, project manager, is father of the project. Eugene C. Mills is chief engineer for the district.

In connection with the $20,000,000 worth of new improvements now being made at Atlantic City, announcement is made by the State Highway Department of New Jersey that the last gaps in a continuous modern highway between New York and Atlantic City will be closed in the early part of the present summer.

ROPING BACK CROWDS.

Most of the parades in San Francisco take as their route Market street, from the Ferry building to the city hall. To confine the crowds to the sidewalks during parades, the police department has adopted the plan of stretching a strong rope along the street near the curb,

SPECTATORS KEPT OFF ROADWAY BY ROPE.

this being supported by heavy wooden posts at regular intervals. The posts are set into holes in the roadway pavement, about a foot out from the curb. To protect the edge of the hole and to hold the post firmly, a flanged iron collar is set into the top of the hloe. An iron cover similar to the cover of a small waterworks valve box) is kept on each hole when the posts are not in place. (One of these covers is shown in the foreground of the illustration.) At

GUARD ROPE FOR CONTROLING PARADE SPECTATORS.

street intersections, the rope is laid in the adjacent gutter until a few minutes before the approach of the parade, when it is drawn across the intersecting roadway by the policeman in charge of each intersection. Police department wagons follow up the parade and the posts are loaded into these and the rope is wound up on drums, the entire equipment being stored in the basement of the "hall of justice."

Lancaster's Centrifugal-Electric Pumps

The following describes the 1919 operation of the Lancaster, Pa., electric pumping plant, which replaced the old steam plant as described in our issue of March 1st, 1919.

The total amount of water pumped for the year 1919 into the standpipe and reservoir was 2,623,-150,000 gallons. The number of gallons of raw water pumped to the filter plant for filtering was 2,789,450,000 gallons. The average head against which the high-duty pump operated was 232 feet, while the low-duty pumps operated against a head of 40 feet. The high-duty pumps used 2,786,750 kw. h., for the year, and the low-duty pumps used 535,269 kw. h. The average highest peak load of 10 minutes duration for any one day was 563 k. w. The average h. p. input for the high-duty pumps was 426.0, while the output was 283.3. For the low-duty pumps, the average h. p. input was 84.2 and the output was 58.2.

The high-duty pumps showed a per cent of efficiency for the year of 66.4; the low-duty pumps showed 71.4. The overall efficiency of the pumps was 67.3 and the station efficiency was 64.9.

The number of kw. h. used per 1,000 gallons pumped through the high-duty pumps was .471 and the low-duty pumps was .443.

The cost of operation for the year was $42,821.72. Basing the operation by steam, using the former steam plant, on the present cost for labor and cost of coal and pumping the same number of gallons, the cost of operation would have been $54,403.76.

DISTRIBUTION OF THE WATER PUMPED.

Of the total number of gallons pumped during the year 1919, 541,906,000 gallons passed through meters for domestic use; for saloons, hotels, breweries and bottling establishments, 104,292,000 gallons; manufacturing purposes, 487,315,000 gallons; schools, churches and colleges, 33,610,000 gallons; water supplied outside of the city limits, 58,002,000 gallons; filter plant, 19,162,000 gallons, or a grand total of 1,213,287,000 gallons. The difference, which is 1,409,873,000 gallons, may be distributed through 6,654 properties that obtain water on a schedule rate, for the flushing of streets, fire purposes and places where water is furnished free.

The filter plant showed a total efficiency in the removal of bacteria of 99.38 per cent.

The plant is being operated with the highest per cent of efficency and every effort made to keep the cost of operation down to a minimum. The plant as it stands today is 95 per cent new. It is in charge of John L. Coyle, chief engineer. We are indebted to C. K. Will, superintendent of the Water Department, for the above facts.

Pavement Tests

Concrete pavements in California are tested by cutting out samples 4½ inches in diameter with a core drilling machine that cuts through the thickness of the pavement in from 5 to 14 minutes according to the age and aggregate of the concrete. Tests of pavements made with broken rock, sandstone gravel, and volcanic rock gravel, all showed a compressive strength of 3,000 pounds per square inch or more.

Liability of Municipalities for Fixed Obstructions in Streets

By John Simpson

Decisions of courts in the various states (except in New England) have established that a municipal corporation is liable for dangerous conditions in its streets caused by its negligence; but not for obstructions which serve a public purpose and are set and maintained with the exercise of reasonable care and not in such a position as will render the street unsafe.

In establishing, maintaining and caring for streets, highways, and public parks, a municipality acts in its governmental and not in its proprietary capacity, and from the earliest times it has been the recognized rule that a municipality is not liable in damages for negligence in performing its governmental functions, unless such liability has been imposed by statute. But by what is termed (in the case of Lane v. Minnesota State Agricultural Society) as an "illogical exception to this rule," it has become firmly established in most of the States, including the Middle and Western States, that a municipal corporation is liable for injuries resulting from defects or dangerous conditions in its streets, caused by its negligence where it is given exclusive authority and control over them and possesses means for their construction, improvement and repair.

The Minnesota Supreme Court considers that the various reasons assigned for making a distinction between such cases and those governed by the general rule are not very satisfactory. The reason most generally assigned is that such municipalities, having been given the exclusive control over their streets, with ample power to provide funds to care for and maintain them, are chargeable with the duty of keeping them safe for travel; and that it follows by implication therefrom that they are liable for failure to perform such duty.

While it is difficult to see why the same reasoning would not also impose liability upon cities for negligence in performing many of their other governmental functions, the exception, logical or otherwise, is now too firmly established to be questioned.

The New England States, however, as well as some others, do not recognize the exception to the general rule, and hold that a city is not liable for defects in its streets unless such liability is expressly imposed by statute.

The liability of a municipality for obstructions in the streets, however, is for negligence only. It is not an insurer against all defects or obstructions, and is not required to do everything that human ingenuity can do to prevent injury to citizens. Its duty is to exercise reasonable care only to construct and maintain its streets and walks reasonably safe for the purposes to which they are devoted, and for the use of persons traveling thereon by the usual methods" by day or by night, and who are themselves using reasonable care. (West Virginia Court decisions.)

Municipalities are not required to furnish the best possible method of passing around natural obstacles. Especially will those be stopped from complaining who, well knowing the means which have been provided for avoiding danger, have sustained injuries in consequence of their own neglect to avail themselves of them. (Mississisppi.)

The Kansas Supreme Court holds that the existence of a post or other object large enough to upset a buggy or wagon running over it within a carriage-width of a traveled track is not necessarily, and as a matter of law, such an obstruction as renders the city liable for injuries occasioned thereby. It may or may not be such an obstruction, depending on a variety of circumstances; and ordinarily, whether it is or not is a question of fact to be determined by the jury. In other words, the city is not bound, as matter of law, to keep not only the traveled track in good and safe condition, but also to keep a space of a carriage-width on each side of such traveled track free from posts, stones or other objects large enough to upset a buggy or wagon running over them. It is, of course, the duty of the city to keep its streets in a reasonably safe condition for travel in the ordinary modes. In the discharge of this duty, in some places it must keep the whole width of the street in a safe condition for travel. In other places it is sufficient to keep a traveled track in good repair.

A person who knows of a dangerous obstruction in a street or sidewalk, and yet attempts to pass it when, on account of darkness or other hindering causes, he cannot see so as to avoid it, takes the risk upon himself. For a much greater reason does he take the risk upon himself if, seeing an obstruction and knowing its dangerous character, he deliberately goes into or upon it, when he was under no compulsion to go, or might have avoided it by going around. (Pennsylvania, New York, Massachusetts, and Indiana decisions.)

In an action against a city for personal injury caused by a runaway team alleged to be due to the breaking of one of a number of hitching posts which the city had caused to be set in a street, it was held in Illinois that the city was not liable. The court said: "There is no duty imposed by law upon the city to provide or maintain hitching posts. If there may be supposed to be any duty resting upon the city in regard to the sufficiency of the posts, as arising from having undertaken to set them, there

could be no such duty as to see that absolutely safe posts were set; but no more would be required, as we conceive, than the exercise of ordinary care in the setting of such posts as would be reasonably sufficient, under all ordinary circumstances, for the purpose of hitching posts."

Many cases support the rule that not every defect or obstruction will render the municipality liable for injury; it is only danger which can or ought to be anticipated in the exercise of reasonable care and prudence, that the municipality is required to guard against.

Where a person, in Mt. Vernon, N. Y., was injured by tripping over a water pipe which projected four inches above the earth surface between the flagstone and the curb, an instruction to the jury was held proper that, if the obstruction was so slight that no careful man would apprehend danger from its existence, the city was not liable, and that it was not chargeable with negligence for an accident which, according to common opinion, was not likely to happen.

The street is to be pronounced sufficient or insufficient as it is or is not reasonably safe for the ordinary purposes of travel, considering the nature of the place and such reasonable limitations as may be put upon the use of the way for travel by virtue of other public necessities, convenience and safety.

Hitching posts, electric light poles, telephone or telegraph poles, hydrants and fire plugs are not considered unlawful obstructions if placed at the curb or margin of the street so as not to render the roadway unsafe. (New York, Pennsylvania, Massachusetts, Indiana, Illinois and Georgia decisions.)

But the fact that contrivances are necessary and usual to effect the purpose desired will not justify the municipality in maintaining them in such a position as will render the street unsafe. In a Mt. Vernon, N. Y., case it was held that an obstruction caused by a waterpipe projecting four inches above the surface differs materially from such objects as carriage stones, lamp posts, and hitching posts, which are easily discernible by a traveler, and the purposes of which require them to be above the grade of the highway. As also in Huntington, W. Va., where two valve boxes projected several inches above the sidewalk.

An instructive case is that of Gottsberger v. the City of New York, where it was held that no recovery could be had against a city for injuries caused by falling over a stringpiece, 12 inches high, placed on the side of a street to protect a water pipe, and to prevent teams going up and down a pier at that point from colliding with each other, unless the stringpiece was shown to be a dangerous obstruction to public travel, since every obstruction in a street is not actionable. The stringpiece was not a nuisance in itself, and city's liability must rest upon negligence. There was nothing out of repair, and consequently, if the city was liable at all, it was liable for permitting something to exist which constituted a dangerous obstruction of the public highway. If every such obstruction were actionable, no water hydrants, trees, hitching posts, telegraph poles, awning posts, stepping-stones—not even the stoops of the houses projecting beyond the house lines—could be permitted to remain. The mere fact that the plaintiff was injured while proceeding in a hurry could not be held sufficient, in the face of the fact that the stringpiece had fulfilled a highly useful purpose for many years and that such purpose was a public one.

The court in the foregoing case referred to a former New York decision, where it was held that it is not negligence to construct a fence separating a bridle path from a foot path in a park; and a horseman who goes on the foot path at night and is injured by his horse falling over the fence, cannot recover. The construction of the fence, so far from having been a negligent act, was held to be a precautionary measure to prevent equestrians from getting upon the walk reserved for pedestrians, and injuring the latter. Referring to the cases, which it considered analogous, where people have been injured by driving against water hydrants, trees, hitching posts, telegraph poles, etc., the court said that in this class of cases it has been invariably held that there was no liability on the part of the municipality; and that the question as to how much of a street shall be set aside for the driveway and how much for the sidewalk, trees, gutter, etc., is, in the absence of a controlling statute, matter of municipal discretion.

While it is the duty of a municipal corporation to use reasonable care to keep its streets in a safe condition to drive upon, it has the right to devote the sides of the streets to other useful public purposes, provided it leaves an unobstructed driveway of ample width for the passage of teams. It may construct sidewalks of a higher grade and gutters of a lower grade than the driveway, place curbing on the line of the gutters, erect hydrants and authorize the erection of hitching posts and stepping stones, as well as poles to support the wires of telegraph and telephone lines. It may lay out grass plots on the sides of the streets, set out trees therein and protect both grass and trees from injury by fences or other reasonable means. It may thus to a reasonable extent, and for a useful public purpose, narrow the driveway and exclude teams altogether from the sides of the street. If a person drives against the curb either on the one side of the street or on the other side of the driveway, it is his own fault or misfortune, for one object of the curbing is to prevent driving beyond its lines. (Horseheads, N. Y.)

The New York Supreme Court has held that a city is not liable for allowing to remain in a street stepping stones placed by third persons to avoid the muddy places, where there was nothing that led to an anticipation of their being or becoming unsafe. The same was held of a stepping stone just inside a curb at Kingston, N. Y.

A city cannot, of course, be held liable for an obstruction which it was not instrumental in establishing and is powerless to remove. The Virginia Court has held that a city was not liable for injury to a traveler from a rope put across a city street, to prevent travel and the resulting noise, by order of the judge of a state court.

Ralph Avenue Sewer, Brooklyn

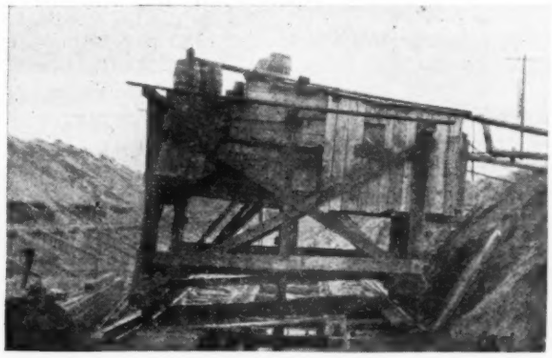
Deep Sheeted Trench Excavated by Steam Shovel and Clam Shell Buckets and Large Invert Concreted Far in Advance of Arch. Aggregate Unloaded and Stored by Power Equipment. Concrete Forms Moved on Cars. Plant Largely Operated by Electric Power.

A section of the Ralph Avenue Sewer, Brooklyn, has been completed at a cost of more than $900,000 and work is in progress on the construction of the lower end of the sewer and on the design for the outfall crossing about 1,000 feet of salt marsh, where the construction has not yet been commenced.

The incompleted section of the sewer consists of a concrete semi-circular invert from 10½ feet to 13 feet, 10 inches in width, that connects at the lower end with twin rectangular sewers 13 feet, 2 inches wide.

It was at first proposed to construct brick arches over the semi-circular invert, but owing to the scarcity of brick during the war the design was changed to a reinforced concrete arch which can be built with greater rapidity than the brick, and with a class of labor more easily secured and managed and more satisfactory in their operation thus, expediting the work and completing it at a slightly lower cost than for the brick construction. The work is executed according to the design and under the supervision of the Department of Sewers, Borough of Brooklyn, by J. F. Cogan, contractor.

EXCAVATOR FOR SEWER TRENCH.



TRAVELING PUMPING PLANT IN ADVANCE OF INVERT.

EXCAVATION, SHEETING, AND PUMPING.

The excavation in sandy soil to a maximum depth of 18 feet has been made with a ¾-yard Bucyrus steam shovel working in the trench, supplemented by two ¾-yard clam-shell buckets operated by stiffleg derricks mounted on 20x30 feet, 8-wheel platforms running on a track of 20-feet gage, one rail of which was laid on each side of the trench. The derricks were operated with hoists, manufactured by the Maine Electrical Company, Portland.

Ground water level being at a height of about 10 feet below the surface, it was found necessary to sheet the lower part of the trench with 6x1-inch planks 8 feet long with the lower end sharpened to a chisel edge. They were driven by a McKiernan-Terry Air Hammer supplemented by an air jet from a ⅛-inch nozzle and a ½-inch pipe. In this manner some of the pile units were driven 4 feet in less than one-half minute. Air pressure was provided by a portable Chicago Pneumatic Tool Company's machine and the supply to the jet was controlled by a valve regulated by the operator.

The trench was drained by electrically driven centrifugal pumps mounted on a car and kept a little in advance of the concreting of the invert where they were operated continuously.

CONCRETE PLANT.

Cement was received in bags loaded on box cars and aggregate on standard gage flat cars hauled over the Long Island Railroad to a point where they were delivered to the contractor's siding. Here they were spotted in the required position near the unloading derrick by a small hoisting engine operating a wire cable that was run through anchored sheaves at both ends of the siding and enabled the cars to be pulled in either direction.

The aggregate was unloaded by a clam-shell bucket operated by the 55-foot boom of a stiffleg derrick equipped with a Nagel Steam Hoisting engine. It was dumped in storage piles from which it was delivered by bucket elevators to a 15-yard hopper bottom storage bin in the upper part of the mixer house.

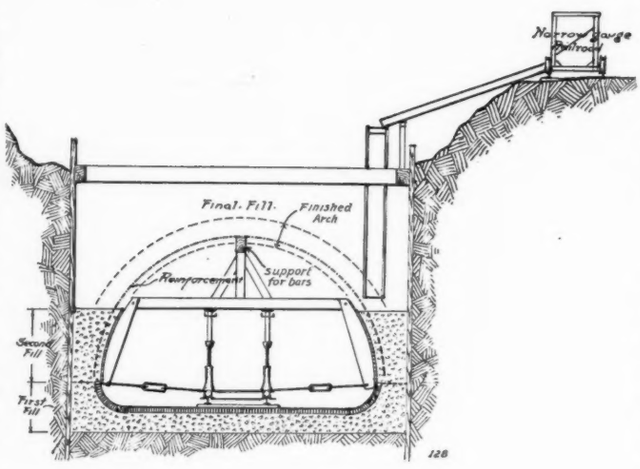
The cement bags were handled by a bag elevator to cement storage house that was located, adjacent to the mixer house, under the concrete floor of a Long Island Railroad bridge that afforded additional protection from the weather.

Aggregate was delivered by gravity to the measuring hopper of the 1-yard cubical mixer manufactured by E. H. Wachs, Chicago. This mixer was installed at an elevation of about 8 feet above

a narrow gage track on which there were operated side dump cars receiving the concrete.

Water supply was obtained by a well point driven 15 feet to the water bearing stratum of sand and connected to a steam pump that maintained an abundant supply in an elevated tank over the mixer house.

Coal was received, like the aggregate, in standard gage cars, unloaded by the clam-shell bucket and delivered by it directly to the boiler house where there was installed a 65 H. P. locomotive type boiler providing steam for the entire plant.



DISTRIBUTION OF CONCRETE.

The average output of the mixer was 110 yards of concrete in one 8-hour shift with a mixer force of 4 men. The machine delivered the concrete directly into small hopper cars with a sliding gate on one side through which the contents were discharged.

The cars were hauled by locomotives on a narrow gage service track extending the full length of the sewer trench. The oil burning steam locomotives first used were afterwards superseded by Plymouth gasoline locomotives, manufactured by J. D. Fate Co., Plymouth, Ohio. The delivery of the concrete to the forms was accurately controlled by the operation of the gates in the cars and the service was considered very rapid and satisfactory.

At the lower end of the trench the surface of the ground was not high enough to permit concrete to be spouted to all parts of the work by track laid on it. Therefore the elevation of the track was increased without extra expense by making an embankment with part of the spoil from the excavation and laying the rails on it.

CONCRETE FORMS.

The arch was concreted in two successive portions for each section. The form for the first or lower section was carried on a small car running on a narrow gage track laid in the invert for that purpose. The sides were adjustable by turnbuckles and the form was raised and lowered by jackscrews to permit accurate adjustment and partial collapse to strip it from the finished concrete.

The semi-circular reinforcement bars were set in position and accurately spaced over the first form and were supported at the crown on a movable longitudinal wooden beam that remained in position until after the haunches had been concreted. When this concrete had set it held the bars firmly in position, permitting the removal of the crown support simultaneously with the collapse and removal of the first form. The second form was similarly constructed and operated in a manner similar to that described for the first form.

Except for the steam plant operating the concrete installation and the locomotive hauling the concrete cars, as much use as possible was made of electricity, furnished by the Edison Company, who laid a special line for the purpose. The use of electricity was considered economical and satisfactory, and was preferred to steam because it could be handled with less experienced operators.

Highway Situation in the Middle Atlantic States

Review of Construction Conditions in Four States in 1919 and Forecast for 1920. $75,000,000 of Work Last Year Hampered by Inefficient Labor, Excessive Labor Turnover Up to 1,00 Per Cent., Shortage of Materials and Cars and by Bad Weather. In 1920 There Are Planned 2,100 Miles of Road at a Cost of $100,000,000 and the Transportation of 11,500,000 Tons of Aggregate and Labor Questions are Serious Problems.

In a paper presented at the fifth annual meeting of the American Association of State Highway Officials, Samuel Knopf, assistant engineer of the Delaware Highway Department, gave a comprehensive survey of "The National Highway Situation in the Middle Atlantic States." The states included in his review were New York, New Jersey, Pennsylvania and Maryland.

The highway construction in 1919 approximated 1,900 miles, and the cost was nearly $75,000,000.

Money for construction was available and, with few excetpions, work began in full swing, with indications pointing to record construction. When the working season had ended, however, only about 40 per cent of the program had been completed. This was due primarily to labor conditions, shortage of materials brought about by lack of equipment available for transportation, and weather conditions.

At first it was thought that labor would be plentiful, especially in view of the demobilizing of the army. But the returned soldiers did not take kindly to road work, and laborers for this had generally to be recruited largely from former munition workers. These had been accustoced to high wages, and were not readily satisfied with wages averaging 45 cents an hour, while the savings from war wages made it unnecessary for them to work. In addition, there was a large exodus to Europe, from certain districts of these states, of labor usually engaged in this kind of work. As the season progressed, labor became more unreliable. Some contractors imported labor from cities 75 miles distant. As an illustration, one job 2½ miles long requiring an outfit of 50 men had, at the end of the work, a pay-roll containing 500 different names. This labor turn-over, besides delaying the progress of the work, influenced bidding prices and quality of workmanship.

There was an actual shortage of materials also. Manufacturers found labor uncertain, their equipment in bad shape, due to forced war work and, with no chance to replace it, they could not keep up with the production demanded. Equipment for transportation was in bad shape. Even now, there is a distinct shortage of cars for the movement of coal, grain and other commodities, and this condition became so acute during the last few months of the 1919 working season that it almost put a stop to the construction program.

On account of bad weather, the Middle Atlantic states were able to conduct actual roadway operations during only about 60 per cent of what is usually a fair average working season. In view of the shortage of material, however, it is doubtful whether much more work could have been done, even had the weather been more favorable.

The lateness and hesitancy of awarding some of the contracts naturally delayed the program. Contractors who were looking for prospective work marked time and did not arrange for needed plant as a result of which, equipment orders piled up as the season progressed and deliveries of plant came too late for the working season. One of the results of this was that bids received late in the season ranged from 10 per cent to 15 per cent higher than those submitted earlier, when every indication had pointed to straight sailing in road construction.

HIGHWAY LEGISLATION.

State legislation affecting highways was notable, especially along two lines: laws affecting the weights and tonnage which could be carried by motor trucks and the use of traction engines on important highways; and legislation empowering the Pennsylvania highway commissioner to acquire land containing stone for road building purposes, which stone may either be used by the state or sold to contractors engaged on highway contracts under the state's jurisdiction.

HIGHWAY REVENUES.

Besides the annual revenue derived by taxation for road purposes, bond issues and other sources of money in the several states were as follows:

Pennsylvania—$50,000,000 in state issues; $17,000,000 in county bond issues authorized, and $8,500,000 in county bond issues proposed.

New Jersey—$5,000,000 in state bond issues; $1,000,000 in county bond issues authorized, and $4,500,000 in county bond issues pending.

New York—$12,000,000 of the bond issue of 1912, and $7,500,000 approximately of county bond issues authorized, with a proposed state bond issue to be introduced to the Legislature for $100,000,000.

Delaware—$2,000,000 in state bond issues; $1,750,000 in county bond issues authorized, and $1,500,000 private fund.

Maryland—No state bonds had been passed or were pending; this road program was carried on by legislative appropriation.

To these amounts of money must be added the considerable increase of funds available under the Federal Aid Act and the Post Office Appropriations Act, this amounting to $32,400,000 for the years 1919-'20 and '21, of which $5,500,000 was applied to road building during 1919.

THE 1920 PROGRAM.

Appropriation for road building in 1920 in these states is even larger than last year's. It calls for the constuction of about 2,100 miles of hard-surface highways at an expenditure of about $100,000,000. What amount of this will be completed is problematical. The limiting factors will be the same as those of last year—the amount of labor and materials available, including the ability to get the materials on the ground, and the lack of experienced and fully equipped contractors' organizations.

The program to be carried out requires the moving of 11,500,000 tons of aggregates, which amount includes the tonnage required to complete the projects carried over from last year's work. The aggregate problem is rendered more difficult by the fact that building operations, railroad improvements and street and road maintenance, which also were seriously curtailed during 1919, and in fact, throughout the war, will require these materials with the anticipated resumption of operations in 1920.

One element of this problem is the transportation of the materials. From the middle of February to the middle of April, 1919, more than 200,000 open-top cars, such as are used for hauling road materials, were standing idle. No new equipment for transportation will be forthcoming under the federal administration, and, owing to the financial difficulties involved in the return of the roads to private ownership, no plans have been formulated for securing new equipment. It therefore becomes more than ever urgent that as much material as possible be moved during the eight or ten weeks following the middle of February, in order to minimize as far as possible the congestion of railroad traffic in the spring and early summer.

As to materials, there is unfortunately an indication that there will again be a shortage of some of these. In the Lehigh Valley, which supplies this district with cement, there is normally on hand at the end of the year about 15,000,000 barrels of cement in stock. Last December there were only about 2,000,000 barrels on hand. Many plants for the manufacture of both cement and other materials and equipment have shut down or gone on to part time for several weeks or months, on account of the shortage of fuel.

As to labor, the labor condition in this section of

the country is at a critical stage. There is nothing to indicate that labor will be more efficient or more abundant or more willing to work at reasonable wages this year than it was last. "Not until labor realizes that it is no longer engaged in war work, that no war profits and war wages exist in honest road building will there be any change in the shiftless, unreliable work performed this year (1919). Any tendency to increase their wages, as was done in some instances this year, seemed to decrease their efficiency. Contractors, to meet this kind of work, have turned to labor-saving machines, and it is safe to predict that these devices will be used where possible."

TO FACILITATE COMPLETING THE PROGRAM.

All hands appear to be realizing that, to cope with this crisis, more efficient co-operation between all parties is necessary. The greatest degree of co-operation between contractors, highway departments, material producers and railroads will be required for even approximately completing the 1920 program. To this end the highway departments issued prospectuses of 1920 work before the end of 1919, announcing that contracts were to be advertised during the months of December to April. It is hoped that this early anouncement of the construction program, giving contractors full opportunity to look over the roads, locate sources of materials, investigate terminals, etc., will stimulate them to assemble plant and materials ready for work, make financial and preliminary arrangements in advance of actual operations, and do everything possible toward completing a large proportion of the season's program.

Several highway departments have carried on extensive material service and propaganda campaigns for the establishment of small local material plants, as well as securing available local supplies for contractors with crushing equipment. Pennsylvania, as noted previousy, has empowered her highway commissioner to purchase and acquire land containing stone suitable for highway purposes, to purchase machinery and equipment to operate such quarries, and to use such stone for their own highways, and to sell it to contractors engaged on constructing roads under the department's jurisdiction.

If possible, material estimates should be allowed, in order to encourage early and regular deliveries of materials in advance of actual operation without imposing a considerable financial burden upon the contractor. In 1917 the Delaware Highway Department found it difficult to secure bids on her road work, until she announced that substantial materials estimates would be allowed, when her entire program was readily put under construction. Materials estimates were allowed during 1919, and, even though shipments were spotty and irregular, enough materials were on hand to tide them over and prevent delay in the work.

Contractors can assist by perfecting adequate organizations and employing labor-saving machines to replace some of their labor. Wonderful strides have been made during the past few years in labor-saving devices used in road building, such as central proportioning plants, direct charging systems, sub-grading machines, finishing machines, etc. Orders for machinery of this kind should be placed early enough to insure their delivery for the present working season.

It is obvious, however, that the controlling factor will be transportation. Railroads should place in service all existing equipment, keep it repaired to the fullest extent, and purchase new equipment if possible. Manufacturing plants should be rated in accordance with their capacity, and the distribution of cars made on such a basis without discrimination.

As to labor, the United States Immigration Bureau reports that the exodus of labor to Europe is about normal, and that there will be a return influx of labor during the early spring. This should have a tendency to stabilize labor conditions and prevent further increase of wages for common labor this year.

In view of these various adverse conditions, it is difficult to foresee or predict what percentage of the 1920 road program will be completed, but the state highway departments will unquestionably make every effort to complete the program outlined, and will be generally backed up by the public, and all concerned will make every effort to put through the greatest possible amount of work this season.

Maintaining a Concrete Street

The city of Fort Collins, Colo., in 1916 constructed 24,000 square yards of six-inch reinforced concrete, and in 1917-18 built 30,000 additional square yards. No repairing was done to this pavement until the spring of 1918, when the joints of the original 24,000 square yards were poured with tar at a cost of 0.2c per square yard.

During 1919, one barrel of pitch (obtained from the Denver gas plants at a cost of $6.30 sufficed to maintain the joints) in 10,000 square yards.

The method of making repairs employed in Fort Collins is as follows: Tar is used having a melting point of 110 degrees F. for work in the spring, or about 105 degrees if in the fall, the lower melting point giving greater elasticity under cold-weather conditions. If the pitch has a higher melting point, it is cut back to 105 degrees by adding a quart of creosote per barrel for each degree reduction in melting point desired. The pitch is heated to between 225 and 250 degrees in portable tar kettle of 110 gallons capacity; a glass thermometer registering to 500 degrees being used during the heating. If the temperature threatens to rise higher, the fire is pulled from under the kettle.

Meantime, the pavement is prepared by sweeping the dust away from the joints by use of a street broom, then thoroughly brushing out the joint with a long handled wire brush and following this with an ordinary house broom; these operations being repeated until all dirt and foreign matter have been removed.

The tar is then poured and the surface covered with dry, coarse sand, preferably preheated to about the same temperature as the tar.

The Fort Collins pavement is practically free from cracks, but where cracks occur they are handled as described above for joints.

Public Works in Paterson, N. J.

Work done by Board of Public Works during 1919, with unit costs, in cleaning, oiling and repairing streets, cleaning and repairing sewers, and collecting refuse with electric and gasoline trucks and horse-drawn wagons.

Paterson, N. J., has an area of eight and one-quarter square miles and a population of about 135,000. The various public works of the city are in charge of a Board of Public Works, with city engineer, H. J. Harder as the engineer.

This board directs the collection of ashes and garbage, the operation of a destructor plant; the cleaning, flushing and oiling of streets; repairing and resurfacing pavements; repairing and cleaning sewers; and some other minor work.

During the year 1919 the board expended for these purposes:

For collecting ashes and garbage	$86,086.05
For operating destructor plant	15,839.09
For cleaning macadam streets	11,795.04
For miscellaneous street work	7,000.21
For cleaning pavements and flushing streets	28,908.06
For repairing pavements	4,777.95
For resurfacing streets	23,707.84
For oiling streets	10,550.83
For repairing and cleaning sewers	14,220.61

STREET WORK.

The amount of cleaning done on macadam streets was 4,101,000 square yards, 5,817 cubic yards of dirt being removed. The cost averaged $2.8761 per thousand square yards of street cleaned, or $2.028 per cubic yard removed. Of the total cost, $1,960 was was for team hire, $7,592 for wages and $2,242 for maintenance.

Resetting curb cost on the average 32.1 cents per lineal foot; flagging gutters, 26.8 cents per lineal foot, and cobble gutter, 38.5 per square yard.

Inspectors on the above work cost $4,897. A new flusher was bought for $9,600, and autos for the city engineers for $1,049.

In cleaning pavements, 11,396 cubic yards of dirt was removed from 54,770,000 square yards cleaned, at a cost of $2.3106 per cubic yard, or $0.4804 per thousand square yards. Of the total cost, $25,700 was for wages, $113 for team hire, and $518 for maintenance.

In addition, 5,016 miles of flushing was done, using 9,683,100 gallons of water, at a cost of 2.92 cents per thousand yards flushed. The flushers used 3,283 gallons of gasoline and 500 of oil. The expenditure for wages was $1,506, and for maintenance $1,070.

Repairing asphalt block cost an average of $1.760 a square yard; brick, $1.51; concrete, $2.00; Belgian block, $1.63; wood block, $.7276. The average for all was $1.90, of which $1.22 was for wages and $.6796 for maintenance. A contract was let for repairing 5,573 square yards of asphalt pavement at $1.68.

In repairing 63,763 square yards of macadam, 6,356 cubic yards of stone was used, and the cost averaged 37.18 cents per square yard. Oiling streets cost 4.37 cents per square yard; 241,533 square yards having been oiled, using 73,259 gallons of oil and 356 cubic yards of stone.

SEWER WORK.

The following were the amounts and unit costs of sewer work: 23,625 linear feet cleaned at 11.65 cents per foot, 272 cubic yards of dirt being removed at $8.12 per cubic yard. Ten repairs cost $86.20. In cleaning 7,048 catch-basins, 1,045 cubic yards of dirt were removed at a cost of $4.08 per cubic yard or 60.55 cents per cleaning, 454 receiving basins were cleaned, 983 cubic yards being removed at an average cost of $3.09 per yard or $6.70 per basin. About 80 per cent of these costs was for wages.

REFUSE COLLECTION AND DISPOSAL.

In collecting ashes and garbage the city used four electric trucks, three gasoline trucks and fourteen horse-drawn wagons. The first removed 55,401 cubic yards at a cost per yard of 45.42 cents plus 10.84 cents for overhead, or 56.26 cents total. The gasoline trucks removed 5,522 cubic yards at a cost of 53.53 cents, plus 28.97 cents for overhead, or 82.5 cents total. Collection by horse-drawn wagons cost 53.73 cents (no overhead given). In all, 142,283 cubic yards was removed at an average cost, including overhead, of 60.5 cents.

The destructor plant incinerated 34,000 cubic yards of this material at a cost of 40.94 cents per cubic yard. In addition, $1,920 was spent in carting 2,983 cubic yards of clinker from the plant.

City engineer Harder has compiled some very interesting data concerning the collection of ashes and garbage by the three types of vehicles, which we will give in another article.

Much Road Construction in Louisiana

At the end of the year 1919, the State Highway Department of Louisiana, according to report of the Bureau of Public Roads, stood first in the Sixth Federal Road District in the number of federal aid road projects submitted to the bureau, agreements for road construction approved, and money paid out as reimbursements to the state account of roads constructed under the federal aid road act.

"According to a tabulation of the status of federal aid projects to January 1, 1920 there are 36 in Louisiana, 19 of which are under construction and 2 of which are completed. The percentage under construction is 52.7 per cent with 5.5 per cent complete. Federal aid has been alloted to the extent of $3,741,751.52. The total aid on active projects is $1,233,991.38 or a percentage of 32.9.

"The tabulation for other states shows: Number of projects in Texas, 122; Oklahoma 22; Arkansas, 51. Projects under construction: Texas, 34; Oklahoma, 5; Arkansas, 20; Completed: Texas 3; Arkansas, 3. Percentage under construction: Texas 27.9; Oklahoma, 22.7; Arkansas, 39. Percentage complete, Texas, 2.5; Arkansas, 5.9; total federal aid alloted $16,091,245.04; Oklahoma, $6,341,878.29; Arkansas, $4,615,210.57.

Annual Paving Statistics

Facts and figures from several hundred cities concerning the amount and nature of work done by each during 1918. (Fourth instalment.)

TABLE NO. 7—RESURFACING PAVEMENTS.

City and State	Kind of pavement resurfaced	Years in service before resurfacing	Kind of traffic carried	Material used for new surface	Treatment of old pavement before resurfacing	Cost of resurfacing per sq. yd.	Use made of old material
California:							
Oxnard	Oil macadam	7	Business	Warrenite	Spiked and broken up; oil cake and part of rock removed.	$1.08	On dirt streets
Redlands	Oil macadam	7	Both	Asphalt	Leveled up with rock asphalt applied at 350° F. covered with screenings.	.225	.....
San Francisco ..	Oil macadam	10	Residence	Topeka mix, 2″	Cleaned, asphalt paint applied by power sprayer.	....	.....
Santa Barbara .	Macadam	10	Business	Oil and rock	Scarified, rock and oil added, rolled.	.18	.....
Connecticut:							
Hartford	Sheet asphalt	21	Business	Sheet asphalt	Old asphalt removed, concrete foundation repaired in places.	....	None
	Macadam	..	Business	Macadam	.....	....	None
New Causan ...	Macadam	Very old	Residence	Gravel & crushed stone	Scarified in some cases.	....	.....
Stamford	Macadam	5 to 10	Both	Tar macadam, 3½″	Scarified and reshaped.	1.00	None removed
Illinois:							
Winnetka	Macadam	10 to 15	Both	Tarvia A & cr. stone, 3″	Scarified and regraded.	.25–.50	None removed
Iowa:							
Indianola	Wood block	7	Business	Tarvia B	Swept clean, hot tar app'l'd, heavily sanded.	....	.....
Sioux City	Wood block	Relaid 1913	Business	Asphalt	Removed blocks and base complete.	4.23	None
Kansas:							
Parsons	Macadam	22	Residence	Broken limestone	Scarified, trued up with grader; stone added and ¾ gal. per sq. yd. of oil.	.305	None removed
Kentucky:							
Madisonville ...	Macadam	10 to 15	Both	Limestone, 6″	Scarified, harrowed, reshaped.	.90	.....
Massachusetts:							
Cambridge	Macadam	..	.....	Tar macadam	Scarified, worthless material removed, new stone added, rolled; Tarvia B penetration and small stone added.	....	.....
	Tar macadam	..	Business	Tar macadam, 6″	Scarified, old material removed; finished as above.	....	For paving side streets
	.....	..	Residence	Tar macadam	Scarified, broken up fine, new stone added as above.	....	.....
	Brick	16	.....	Bitulithic	Holes and depressions filled with bit. binder course.	....	.....
Haverhill	Macadam	8 to 12	Both	Stone & asphalt	Scarified and part removed.	....	Resurfacing dirt roads
Lawrence	Sheet asphalt	20	Both	Warrenite	Old asphalt removed, concrete base cleaned (cost, $0.30).	1.93*	.....
Lexington	Bit. macadam	15	Both	Stone & Tarvia B, 4″–5″	Scarified, old tar removed, harrowed, rolled.	....	Subgrading roadways & sidewalks
Winchester	Macadam	..	.....	Brok. stone & Tarvia X	Brought to uniform cross-section.	....	None removed
Nem Hampshire:							
Nashua	Macadam	..	Both	Asphalt	Scarified and rolled.	....	.....
New Jersey:							
Irvington	Telford macadam	7	Business	Asphalt surface treat.	Scarified.	.40	None removed
Ridgefield Park.	Asphalt macadam	7	Both	Stone & Tarvia X	Scarified, raked over; 1½″ of ¾″ stone added, Tarvia and screenings.	.65	None removed

New York:							
New York-Bronx	Asphalt block	..	.....	Granite block	Pavement removed, new base laid.	....	.....
	.....	..	.....	Sheet asphalt; "Durax"	Surface removed and old base used where good.	....	.....
New York-Manhattan	Asphalt block	10	Business	Sheet asphalt	½" removed after heating. (Will be described in detail in a week or two.)	....	.....
N. Tonawanda	Macadam	3	Both	Slag, tar & screenings	Scarified; 4" of crusher-run slag, 2½" of graded slag, screenings for binder. Tarvia, ¾ gal. per sq. yd. by penetration method, then screenings; then ⅛ gal. Tarvia and screenings.	.98	.....
Port Jervis	Gravel	..	.....	Shale	.....	....	Dressing shoulders .....
Syracuse	Asphalt and brick	18 to 25	Both	Asph., brick & bit. conc.	Replaced with same class of materials.	Asph., 1.90 Brick, 3.25	Repairing brick pavements .....
Troy	Granite blocks	30	Business	Same blocks	Blocks removed, split, renapped and relaid.	....	.....
Pennsylvania:							
Butler	Brick, slag base	15	Business	Brick	Old base resurfaced with 3" of slag screenings and well rolled. Some old brick turned and used.	2.08†	.....
Mechanicsburg	Brick	9	Both	Brick	Badly worn brick removed, cushion examined.	1.92	Brick used for gutters and crossings
Tennessee:							
Harriman	Macadam	20	Both	Bit. macadam	Scarified.	.10	.....
Texas:							
Brownwood	Macadam	3 to 5	Business	Trap, asphalt binder	Scarify and roll.	....	.....
Temple	Brick	6	Business	Asphalt	Flushed, hand-cleaned with wire brooms, swept and flushed.	.28	.....
Vermont:							
Burlington	Macadam	..	Both	Standard binder B	Scarified, reshaped, new stone added where necessary.	1.00	Patching dirt roads
Washington:							
Raymond	Plank	10	Both	3" plank	High spots trimmed down, low ones shimmed up.	.99	.....
Spokane	Asphalt	18	Business	Asphalt	Surface heater used and 1½" added.	.90	.....
Walla Walla	Asphalt	10 to 15	Both	Bitulithic	Old surface removed, base swept.	1.80§	Spread on another road, broken up and rolled
Wisconsin:							
Wausau	Macadam	6	Residence	Asphalt oil	Scarified, new aggregate added, rolled and oiled.	1.00	.....

*In addition to $0.30 for preparing base. †Includes resetting curb. §For 2" top and binder; $1.40 for 2" top only.

Table No. 9.—Gravel Pavements Laid in City Streets During 1919.

City and State.	Yards or miles laid.	Av. cost per sq. yd.	Thickness, inches.
Colorado:			
Leadville	½[a]	[b]...	6
Massachusetts:			
Greenfield	4,000	...	4
New Hampshire:			
Nashua	20,000[c]	$1.00[a]	..
Washington:			
Dayton	800[c a]	...	6
Waterville	113	0.58[a]	7

[a]Gravel not rolled.
[b]Work was volunteered and gravel was donated.
[c]Gravel was rolled.
[a]Does not include other work.

Table No. 10.—Bitulithic Pavement Laid in City Streets During 1919.

City and State.	Yards or miles laid.	Average cost per yd.	Base: Kind.	Base: Thickness, inches.
California:				
Oxnard	70,103	$1.80	....	4
Santa Barbara	[a]79,235	1.78	concrete	4
Colorado:				
Pueblo	76,900	2.26	concrete rock	4-5 4
Idaho:				
Boise	7,902[d]	2.22[a]	....	..
Iowa:				
Centerville	35,000	3.77	1:3:5 concrete	5¼
Massachusetts:				
Cambridge	55,375	2.00[b]	old brick	..
Lawrence	17,346[c]	2.23	macadam	..
Lawrenceville	6,110[c]	2.23	concrete	..
Minnesota:				
Duluth	44,622	3.50[a]	concrete	6
Montana:				
Bozeman	23,486	2.63[a]	crushed rock	4
Nebraska:				
Columbus	65,663	2.84	concrete	5
New Jersey:				
Irvington	3,061	3.80	concrete	6
New York:				
Gloversville	3,800	2.32	old	..
No. Tonawanda	13,700	3.09	....	5
Troy	18,600	3.25	1:3:6 concrete	5
Wyoming:				
Sheridan	18,000	2.64[a]	concrete	5

[a]Bitulithic and Warrenite.
[b]Cost including base.
[c]Warrenite.
[d]Gravel.
[a]Does not include other work.

Table No. 11.—Macadam Laid in City Streets During 1919.

City and State.	Yards or miles laid.	Av. cost per sq. yd.	Thickness, inches.
California:			
Kentucky:			
San Francisco	4,063	$0.967	..
Madisonville	11,000	0.90	6
Minnesota:			
Duluth	25,000	...	6
New York:			
Troy	2,200	2.50	6
Oregon:			
Eugene	1,600	1.00[a]	6
Pennsylvania:			
Mechanicsburg	3,505	1.86[a]	..
Rhode Island:			
Providence	46,377	...	6

[a]Does not include other work.

Since the organization of its highway department in 1917 Delaware has built 70 miles of fine roads, put 30 miles more under contract, and completed surveys for more than 50 miles to be built by the state which has about $3,000,000 available for expenditure this year.

New York State Highway Commissioner, Frederick Stuart Greene, has recommended to the legislature the purchase by the state of road machinery and road materials which he estimates would effect an annual saving of $750,000.

Cost of Operating Contractors' Plant

Editor Public Works, New York City.

Dear Sir:

The writer was especially interested in an article on page 304 of the issue of "Municipal Journal" of November 15. The article in question was a notice of action taken by the Association of General Contractors of America regarding machinery manufacturers giving costs on the operation of equipment to public officials and having these costs so low that a contractor could not bid anywhere near the figures stated and make money.

It is the writer's opinion that their attitude is absolutely a just one and that the contractors have a real grievance when this is done. The writer, however, has been selling machinery for the last ten years and has made repeated efforts, over a period of seven of the ten years, to obtain actual operating costs on the kinds of equipment which we sell. Within the last few months he sent out a series of twenty letters to representative contractors, asking for typical costs under ordinary operating conditions. From the whole series of letters there was only one reply, and the costs given in this case were only approximate.

As long as the contractors take this attitude and refuse to give any information the writer does not exactly see how they can expect to have any salesman give a prospective customer anything more than theoretical cost units, giving items covering original purchase price, interest, depreciation and operating expenses as they would appear on paper, realizing that these are probably too low, but with no other figures to aid them.

Should not, in your opinion, the contractors, if they want this matter corrected, take some definite sort of action toward supplying reliable figures?

You must, of course, realize that many cities, counties and states and highway departments operating equipment themselves give out figures (some of which are sent to you and similar journals for publication) which are also totally unreliable, since items of overhead, and often interest and depreciation, are left out entirely; and the writer has even suspected that some of the published articles have gone beyond this point and purposely neglected to state known items of cost in order to make the operating conditions in their city seem very low, hoping for the appreciation of their own taxpayers and to be able to use these figures to beat down the contractors' bids on such parts of their work as they might be letting by contract.

Would be glad to have a discussion along this line in the editorial columns of "Public Works."

Yours very truly,
KINNEY MANUFACTURING CO.,
WILLIAM E. WORCESTER,
Manager, Philadelphia Office.

Making a Road on Wet Ground

About 700 feet of road was laid through a very wet spot on a hill in Lee, Mass., in the following manner, as described by Harry W. Heaphy in a communication to "Public Works":

A four-inch vitirfied pipe was laid three feet deep in the middle of the road, the joints being left open. The ditch was then filled with broken stone. Previous to this the road had been straightened and some necessary cutting and filling done. The drainage ditch having been constructed, cinders were placed so as to give a thickness of eight inches after compacting.

Following the construction of this piece of road there was a very rainy season, and on either side of this stretch the road was quite muddy, but this drained piece was as dry as a floor. This work was done by town labor.

Reinforcing Old Concrete Bridge Floor

The 3-inch concrete floor slabs in steel truss bridges at Blossburgh, New York were so much damaged by heavy freight traffic that it was recently necessary to resurface them.

After being swept and washed clean the surface was treated with a 5 per cent solution of hydrochloric acid which was washed off and followed by a thin wash of cement grout on which there was immediately laid a 2-inch course made in the proportion of 2½ bags of cement to 1 cubic foot of sand and 5 cubic feet of ¼ to ¾-inches trap rock mixed with the minimum amount of water necessary to make it plastic.

As no construction joints were provided, air cracks developed in the lines of the old expansion joints 18-feet apart but have not opened or caused any injury to the pavements which has been in service for two years without showing any signs of broken bond or cleavage where old and new concrete are joined. The work is considered entirely satisfactory and is expected that the floor will last as long as the bridge structure itself.

Value of Short Hauls

The importance of reducing distances for highway transportation is illustrated by the following table prepared by A. R. Hirst, State Highway engineer, Wis. On the conservative allowance of 10 cents per mile per vehicle cost of transportation, the capitalized value of each mile saved varies from $73,000 to $7,300,000 according to amount of traffic amounts which certainly justify considerable expenditure for the rectification of roads:

Average Number of Vehicles per day	Saving to Owners per Year	Saving Capitalized at 5%
100	$3,650	$73,000
250	9,125	182,500
500	18,250	365,000
750	27,375	547,500
1,000	36,500	730,000
2,000	73,000	1,460,000
5,000	182,500	3,650,000
10,000	365,000	7,300,000

The Ingahm County, Mich., board of supervisors has reduced the salaries of the county road commissioners from $1,500 to the nominal sum of $150 a year, plus necessary expenses, in the hope of eliminating any financial attraction and securing more competent and public spirited administration of the work.

The Pennsylvania State Highway Department states that the average cost of road construction thus far has been $41,500 a mile. This covers all types of roads for which $27,020,120 is the cost and 648 the mileage. Reinforced concrete has been constructed for $44,000 a mile, while the average for bituminous concrete is $41,000; for sheet asphalt, $15,000; while brick roadway, (usually hill construction) of which only 6.75 miles have been let runs to nearly $64,000 a mile.

LEGAL NOTES

A Summary and Notes of Recent Decisions—

Rights of Court to Interfere with City Officers—Release of Valuable Rights.

(N. Y. Sup.) The courts must not interfere with the discretion of local officers and municipal bodies, and must not attempt to manage the affairs of a municipal corporation, but may restrain an abuse of discretion in releasing valuable rights for a consideration that will substantially fali.—People's Gas & Electric Co. of Oswego v. City of Oswego, 177 N. Y. S. 625.

Annexation by City—"De Facto Corporation."

Cal. App.) Where there has been an attempt, under Municipal Annexation Act of 1913 and amendments thereto, to annex one city to another, and where authorities of former city have declared annexation to have been carried at an election held to decide the question, and where such city as an incorporated city has ceased to function, and the latter city has assumed jurisdiction over its territory and inhabitants, the latter city, as to such annexed territory, is a de facto corporation.—Coe v. City of Los Angeles, 183 P. 822.

The requisites of a de facto corporation are a charter or general law under which such a corporation, as it purports to be might lawfully be organized, an attempt to organize thereunder, and actual user of the corporate franchise.—Id.

Ordinance Requiring Privies Void.

(Fla.) A city ordinance, requiring the establishment of privies in every house and building, however used or occupied, and requiring compliance with the provision of the ordinance within 15 days after notice from health commissioner, or within such further time as he may allow, permits an arbitrary discrimination by him, and is void.—Ellis v. Thiesen, 82 So. 607.

Power of City to Grant Lighting Franchise.

(S. D.) A special charter giving a city power to provide for lighting the streets and erecting posts for conveying electric lights and lines and to regulate the distribution of gas and other illuminative fluids empowers the city to grant a franchise to an electric light corporation to furnish electricity to the ctiizens.—City of Watertown v. Watertown Light & Power Co., 173 N. W. 739.

Liability of City to Pay Contract Price.

(U.S.C.C.A.Okl.) Where a municipal corporation, which has power to make a contract for internal improvements, contracts for them and stipulates that the agreed price shall be paid out of funds t obe realized from special assessments, which it has power to make, but fails and refuses to make sufficient valid assessments, it becomes primarily liable to pay the contract price itself.—Oklahoma City v. Orthwein, 258 F. 190.

Zoning Ordinance Applied to Laundries Constitutional.

(Cal. App.) Los Angeles Ordinance No. 22798 (New Series), a residence district ordinance, and No. 26555 (New Series), providing that in order to establish an industrial district within a residence district it is necessary to get a petition signed by property owners, etc., are constitutional and apply to laundries.—Sam Kee v. Wilde, 183 P. 164.

Right to Impound Animals at Large.

(Colo.) The city of Pueblo has the right to impound animals running at large and to charge the delinquent owner a reasonable amount for so doing.—City of Pueblo v. Kurtz, 182 P. 884.

Letting Office of City Treasurer Unconstitutional.

(Tex. Civ. App.) A city charter, if it purports to authorize the letting by contract to the highest and best bidder of the office of city treasurer, etc., to that extent is unconstitutional.—City of Corpus Christi v. Mireur, 214 S. W. 528.

Power of City to Regulate Business.

(Ohio) When a city has the right ,under its police power, to impose a regulation upon a business, the validity of an ordinance relating thereto cannot be attacked merely because its scope was not extended to cover the entire field of possible abuses which such ordinance seeks to prevent.—Yee Bow v. City of Cleveland, 124 N. E. 132.

Councilman as Tax Equalizer—Salary of Officers.

(Cal. App.) Under the charter of Richmond, providing that no member of the council shall hold any other municipal office, that the council shall act as a board of tax equalization, and that the councilmen shall receive $5 per day while performing that duty, but no other compensation, unless provided by ordinance, they perform the duty of equalization as members of the council, so that an ordinance providing a salary for them increases their compensation, within Const. art. 11, § 8, providing that this shall not be done during their term of office.—Cameron v. City of Richmond, 183 P. 604.

Under statutes relating to street improvement contracts, contractor cannot impede or embarrass the municipality, or vex its officers, by putting the contract on the market to be sold or bartered as a commodity.—Id.

Provision of sidewalk construction contract, requiring city's consent to assignment of contract is valid and enforceable.—Id.

Assignment of contractor's interest in sidewalk construction contract without city's consent, in violation of provision of contract requiring such consent, conferred no rights upon assignee.—Id.

Where sidewalk construction contractor assigned interest in contract without city's consent in violation of contract, a purchaser from assignee of assignee's right, title, and interest in special assessments acquired no rights in assessments, since assignment, being invalid, conferred no rights upon assignee.—Id.

Civil Service Examinations—Powers of Health Board—Information to Applicants.

(Cal.) Under the San Francisco City Charter, the board of health and the Civil Service Commission are independent of each other, and the board has no authority to prescribe qualifications for civil service eligibles.—Pratt v. Rosenthal, 183 P. 542.

The fact that the Civil Service Commission of a city placed veterinarians on the same basis as persons experienced in handling meat, fish, and fowl in examinations for market inspectors does not show an abuse of discretion.—Id.

A civil service examination notice which stated that copies of certain regulations would be distributed as long as the supply held out does not indicate a violation of San Francisco City Charter, prohibiting special information being furnished any applicant, since it will be presumed that any applicant failing to secure a copy would be allowed to inspect the original records.—Id.

Davenport, Iowa, is open to a proposition for the removal of its garbage by contract. The contract that has been in operation for several months has been abandoned with disastrous results for the city which has no garbage wagons and will have to expend approximately 6,000 dollars to supply them if it makes its own collection.

NEWS OF THE SOCIETIES

March 1-5. NEBRASKA ROAD INSTITUTE. Third meeting, Temple Theatre, Lincoln, Neb. Chairman, Clark E. Mickey, University of Nebraska, Lincoln, Neb.

March 8-9—INDIANA SANITARY AND WATER SUPPLY ASSOCIATION. Annual Convention at French Lick, Ind. Secretary-Treasurer, L. R. Taylor, French Lick, Ind.

March 8-10. INDIANA SOCIETY OF SANITARY ENGINEERS, Richmond, Ind. Secretary, Indianapolis, Ind.

March 10.—VERMONT SOCIETY OF ENGINEERS. Meeting and convention at Burlington, Vt., Secretary, George A. Reed, Montpelier, Vt.

March 16-18. — AMERICAN RAILWAY ENGINEERING ASSOCIATION. Manhattan Building, Chicago.

March 24-25. NATIONAL WHOLESALE LUMBER DEALERS ASSOCIATION, Washington, D. C. Secretary, 66 Broadway, New York.

March 24-25.—NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES. The first annual meeting at Chicago. Executive Secretary, John C. Frazee, Drexel Building, Philadelphia, Pa.

March 24-26. SOCIETY OF INDUSTRIAL ENGINEERS, Bellevue-Stratford Hotel, Philadelphia. Secretary, 327 South La Salle St., Chicago.

March 25. NORTH CAROLINA PINE ASSOCIATION, Norfolk, Va. Secretary, Norfolk, Va.

April 12-17. — UNITED STATES GOOD ROADS ASSOCIATION. Eighth Annual Convention, Hot Springs, Ark. Director-General, J. A. Rountree, 1021 Brown-Marx Building, Birmingham, Ala.

April 16-17. — BANKHEAD NATIONAL HIGHWAY ASSOCIATION. Fourth Annual Convention, Hot Springs, Ark. Secretary, J. A. Rountree, 1021 Brown-Marx Building, Birmingham, Ala.

May 10-11.—AMERICAN ASSOCIATION OF ENGINEERS. Sixth Annual Convention, St. Louis, Mo. Secretary, C. E. Drayer, 63 East Adams Street, Chicago.

May 18-21.—NATIONAL ELECTRIC LIGHT ASSOCIATION. Annual convention, Pasadena, Cal. Acting Secretary, S. A. Sewall, 29 West 39th Street, New York City.

Associated General Contractors of America.

At the annual meeting, Chicago, February 18-19, the opening address was made by President D. A. Garber, responded to by an address of welcome by William Hale Thompson, Mayor of Chicago. Important reports were presented by G. W. Buchholz, secretary; C. F. Mullen, Treasurer, and by the Chairman of the Auditing Committee, A. P. Greensfelder; Membership Committee, L. C. Wason; Publicity Committee, Edward Haupt; Committee on Codes, Thomas Bentley; Committee on Transportation, G. W. Buchholz; Committee on Ethics, Noble Foster Hoggson; Committee on Legislation, W. A. Rogers; Committee on Methods, A. P. Greensfelder; Committee on Labor, M. D. Smith; Committee on Contracts, J. W. Cowper; Committee on Construction Development, E. J. Thomas; Committee on Constitution and By-Laws, L. C. Wason; Finance Committee, F. J. MacIsaac, and the various Convention Committees.

W. A. ROGERS
President—1920.

The following papers were presented: Organizing the Construction Industry, Ernest T. Trigg, president National Federation of Construction Industries; Prices, Production and Construction, Harold G. Moulton, Professor of Economics, University of Chicago; Industrial Relations, Dudley Taylor, District Counsel, League of Industrial Rights, and J. H. Ellison, Winston Brothers Co., St. Paul, Minn.; Forms of Contracts, Sutton Van Pelt, Division of Waterways, Department of Public Works, State of Illinois; James O. Heyworth and A. E. Wells; Standards in Construction, A. B. Segur, A. B. Segur & Co., industrial engineers, Chicago; A National Department of Public Works, Gardner S. Williams, National Public Works Department Association, Washington, and Frank I. Bennett, Director Ill. State Department of Public Works and Buildings; The Disposition of the Realroads, Samuel O. Dunn, editor Railway Age, and Richard Waterman, secretary Railroad Commission, Chamber of Commerce, U. S. A.; Washington Affairs, George R. Shields; The 1920 Highway Program, I. T. Voshell, chief, Bureau of Public Roads, U. S. Department Agriculture; Improving State Highway Contracts, A. R. Hirst, State Highway Engineer of Wisconsin, and Clifford Older, Chief Highway Engineer of Illinois, and H. W. Church; The Expense of Estimating, Henry K. Holsman, president, Illinois Chapter, A. I. A.; the National Board of Jurisdiction Awards, E. J. Russell, chairman, National Board of Jurisdiction Awards; The Joint Conference Plan With Labor, A. P. Greensfelder, Fuim-Colnon Construction Co., St. Louis.

There was a large attendance at the smoker and entertainment on the evening of February 18, on the inspection trip to the plant of Universal Portland Cement Co., where luncheon was served February 19, and at the annual dinner, February 19, where D. A. Garber was toastmaster and the sentiment "To the Associated General Contractors in 1920" was responded to by W. A. Rogers, W. O. Winston, R. G. Col-

lins, Jr., Walter Cahill, Frederick L. Cranford, T. T. Flagler, J. W. Cowper, C. F. Mullen, E. J. Thomas, M. D. Smith, George Watson, A. P Greensfelder, Thomas Bentley and L. C. Wason.

The officers elected for 1920 were: President, W. A. Rogers, president Bates & Rogers Construction Company, Chicago; first vice-president, T. T. Flagler, president The Flagler Company, Atlanta; second vice-president, J. W. Cowper, president The John W. Cowper Company, Buffalo; third vice-president, W. O. Winston, president Winston Brothers Company, Minneapolis; treasurer, C. F. Mullen, secretary and Treasurer The Masters & Mullen Construction Company, Cleveland. Members of the Executive Board (four whose terms expire January, 1923)—R. G. Collins, Jr., Cumberland, Md.; Walter Cahill, Great Lakes Dredge & Dock Company, Chicago, Ill.; Arthur Bent, Bent Brothers, Los Angeles, Cal.; George Watson, Watson Company, Dallas, Texas..

The creation of the Advisory Board was accomplished by the election, to hold office for one year, of D. A. Garber (chairman), president North-Eastern Construction Company, New York City (retiring president); W. A. Rogers, president Bates & Rogers Construction Company, Chicago (retiring first vice-president); F. J. MacIsaac, secretary and Treasurer Smith Hauser & MacIsaac, New York City (retiring director); George J. Glover, director New Orleans General Contractors Association, New Orleans; Frederick L. Cranford, president Frederick L. Canford, Inc., New York City.

Very strong support was given to the carefully formulated plans presented for the development of the association's interests and the most enthusiastic endorsement was shown by the subscription of $200,000 for this purpose.

Important revisions and amendments were made to the constitution and by-laws that more clearly defined the special aims of the association, grade its membership, enlarge the Executive Board and provide for an Advisory Board. They also specified a sliding scale of dues for the different classes of members.

North Carolina Drainage Association.

At the convention to be held Feb. 25, 26 and 27 at the Elks Hall, Hotel Louise, Washington, D. C., the principal papers presented and topics discussed will include:

Drainage Work in the Southeastern States, by Judge N. A. Morris, president, Southern Drainage Journal, Marietta, Ga.

Settlement of Our Reclaimed and Unused Areas, by Clement S. Ucker of the Southern Settlement and Development Organization.

Flood Control as Related to Drainage, by Thorndike Saville, Professor of Hydraulic and Sanitary Engineering, University of North Carolina.

Some Drainage Problems in the Great Swamp Area of North Carolina, by H. M. Lynde, Sr., Drainage Engineer, Office of Public Roads and Rural Engineering.

Problems of the Drainage Contractor, by C. W. Hodges, Newbern, and J. A. Wilkinson, Belhaven.

Malaria Control, an illustrated lecture, by Dr. Chas. E. Low, Supt. of Health of New Hanover County; given under auspices of the N. C. Landowners' Association.

Tile Drainage of Flat Lands, by F. O. Bartel, Drainage Engineer, N. C. Department of Agriculture.

Tile Drainage Contests Conducted by N. C. Drainage Association, by Prof. M. E. Sherwin.

Making Drain Tile, by W. C. Boren, president Pomona Terra-Cotta Company.

Distribution of Clays in North Carolina Suitable for Making Drain Tile, by Col. Joseph Hyde Pratt.

Five-Minute Reports on Drainage Districts.

Piedmont Drainage, by W. D. AIexander, M. P. Moore, L. O. White, Q. E. Smith and C. A. Black.

Drainage Projects of the Coastal Plain, by W. K. Allen, C. W. Mengel, R. R. Eagle, B. M. Potter, M. W. Thompson, J. I. Heritage, F. F. Wetmore, J. L. Becton, C. G. Elliott, Z. V. Norman, O. L. Williams, J. D. Grimes, J. I. Duncan, Frank M. Wooten, Pat Matthews and C. C. Howard.

Results of Drainage on the Norfolk Southern Farms, by R. K. Smith, vice - president Norfolk Southern Land Co.

Potter Farms, by J. E. Shepherdson, general manager.

Soils of Some of the Swamp Areas and Their Agricultural Values, by Wm. Battle Cobb, of the U. S. Bureau of Soils.

Maintenance of Drainage Ditches, by W. K. Allen and W. D. Alexander, drainage engineers.

Five minute discussions of the North Carolina Drainage Law, by Congressman Small, W. Lee Crowell W. D. Alexander, P. H. Johnson and J. D. Paul.

Nebraska Road Institute.

At the meeting at Lincoln, Neb., March 1-5, there will be a number of trips of inspection to local works; an evening smoker; the annual meeting of the Nebraska Engineering Society; an address by Governor S. R. McKelvie; the annual banquet; and there will be presented the following papers.

Federal Aid in Nebraska, by Jas. C. Wonders, Federal District Engineer; Administration and Organization of Department of Public Works, by E. H. Morey, Chief of Bureau of Roads; Construction of State Highways, by A. S. Mirick, Chief Construction Engineer, Department of Public Works; Maintenance of State Highways, by Geo. E. Johnson, Secretary Department of Public Works; County Highway Patrol for Maintenance, by A. H. Edgren, Lancaster County Engineer; Evolution of Nebraska's Highways, by Prof. Geo. R Chatburn; Evolution of a County Bridge, by D. L. Erickson, Deputy County Engineer, Lancaster County; Highway-Railway Crossings, by F. T. Darrow, Ass't Chief Engr., C. B. & Q. R. R.; Nebraska Cement Company, by Louis J. Hoenig, Sales Manager; Nebraska's Road Material Resources, by Dr. Geo. E. Condra; Nebraska Good Roads Association, by Geo. F. Wolz, President; The Use of Trucks in Building and Maintaining Roads, by Geo. E. Johnson, Secretary Department of Public Works; Motor Operation and Transport Service, by Marcus Potete; Motor Transportation in Nebraska, by Loyd Winship, Secretary and Treasurer, Hebb Motor Company; Motor Transport Rates, by Thorn Brown, State Railway Commissioner; Model Methods in Highway Educational Work, by James W. Brooks, Director, Educational Bureau, Federal Highway Council; Gravel Roads in Iowa, by Prof. T. R. Agg, Iowa State College; Inspection and Testing Road Materials, by Prof. Clark E. Mickey; Latest Developments in Concrete, by A. N. Johnson, Consulting Engineer, Portland Cement Association; Construction of State Highway Project No. 81 Concrete Road at Fremont, by Clark Brown, Project Engineer; Construction and Maintenance of Bituminous Macadam Pavements, by Prof. Geo. E. Martin, Barrett Mfg. Co.; Brick Paving, by Clark R. Mandigo, Chief Engineer, Western Paving Brick Mfg's Association; Financing County Paving, by Geo. Wolz, President Good Roads Association; Highway Program for 1920, by Geo. E. Johnson, Secretary Department of Public Works.

The Connecticut Society of Civil Engineers.

The thirty-sixth annual meeting was held at Charter Oak Hall, Hartford, Feb. 17-18. The importance of

establishing the proposed National Department of Public Works and The Super Power line, both subjects continued from former meetings, were discussed, and papers presented on:

State Parks, by Albert M. Turner, Field Secretary, Connecticut State Park Commission.

Some War Time Developments in Electrical Communications and Allied Fields (Illustrated with lantern slides), by Dr. F. B. Jewett, Chief Engineer of the Western Electric Company.

Pictures in War, the Motion Picture and Its Unknown Part in Winning the War, by Jim Handy.

Stevenson Dam, by H. J. Hoard, Chief Engineer at Stevenson Dam.

Elimination of Grade Crossings, by F. Irvine Rudd, Engineer of the Public Utilities Commission.

Work of the State Board of Health, by Frank Bachman, Chemist and Engineer, Industrial Waste Department, Bureau of Sanitary Engineering, Connecticut State Department of Health.

A Quarry in Action. A novel exhibit of how a quarry is worked under modern methods, showing moving picture of The New Haven Trap Rock Company's quarry, North Branford, Conn.

Bridgeport Sewage Disposal, by James A. McElroy, City Engineer.

On the evening of Feb. 17 there was a dinner at the Hartford Club, and a reception to the newly elected officers, who are as follows:

Charles J. Bennett, Hartford, president; Thomas A. Scott, New London, first vice-president; J. Frederick Jackson, New Haven, second vice-president; Henry J. Kellogg, New Haven, secretary and treasurer; W. Howard Sharp, West Hartford, assistant secretary.

American Association of Engineers.

L. B. Hitchcock has been elected president and D. A. McClung secretary of the Phoenix, Ariz., chapter.

The following officers have been elected by the Lincoln, Neb., chapter; Geo. W. Bates, president; R. E. Davis, vice-president; Geo. K. Leonard, secretary.

Chapter charters have been granted in Carson City, Nevada; New Haven, Connecticut; Warren, Arizona; Delaware College, Newark, Delaware; Odgen, Utah; Trenton, New Jersey; Atlanta, Georgia; Carnegie Institute of Technology; and club certificates to petitioners from Santa Fe, New Mexico, and Utica, New York.

The board of directors has approved the amalgamation with the Michigan Engineering Society and constitution which, after adoption by the society, will provide for the establishment of the Michigan Engineering Society as a state assembly of A. A. E.

The plan of amalgamation with the North Carolina society, which recently voted to enter A. A. E., was also approved on a similar basis.

The membership of the American Association of Engineers on February 19 was 12,670. Applications during January, 2,025; during the first nineteen days of February, 757.

Associated Manufacturers of Water Purifying Equipment.

The annual meeting was held at the Bellevue Stratford Hotel in Philadelphia on February 4, 1920. Practically the entire membership was represented at a meeting of unusual progress and interest.

Born out of war-time necessity to assist in speedy production of water purifying equipment, the association now continues with the object of assisting in every way the water purification industry as a whole. Standard sizes for pressure filters have been agreed upon and the committee is also working on the standardization of contracts.

Arthur M. Crane, representing the New York Continental Jewell Filtration Company, was elected chairman for the year 1920, succeeding F. B. Leopold of the Pittsburgh Filter Company, who was elected to the Executive Committee to fill the vacancy created by the election of A. S. Garrett of the American Water Softner Company to the position of vice-chairman succeeding Mr. Crane. H. G. Tate, of the Borromite Company of America, remains secretary and treasurer.

Membership in the association is open to all firms, companies and individuals regularly engaged in the manufacture of water purification qeuipment, whether for filtration, softening or sterilization. It is the earnest desire of the association to have its membership include every organization covered in this classification.

American Concrete Pipe Association.—Convention was held Feb. 20-21 in the rooms of Western Society of Engineers and at the Great Northern Hotel, Chicago. The meeting separated into the Concrete Pipe Division under charge of J. E. Moody, engineer of the Massey Concrete Products Corporation, Chicago, and the Drain Tile Division, each of which held separate meetings.

PERSONALS.

Gannon, W. J., superintendent of Fitchbury, Mass., street department, died January 5.

Farrar, Frank E., is a candidate for Commissioner of Public Works, Farmingham, Mass.

Calhoun, John E., has been elected Highway Commissioner of Franklin, N. H.

Head, Orwin W., has been elected Superintendent of Streets of Concord, N. H.

Bingham, C. A., has been elected City Manager of Watertown, N. Y.

Jones, Richard A., for many years Superintendent of Streets, Waltham, Mass., has been retired with a pension.

Beal, Henry F., has been elected City Manager of Waltham, Mass.

Riddle, Karl, Abilene, Kansas, has been appointed resident engineer of federal aid road work in Dickinson Co.

Martin, George E., has resigned the professorship of Highway Engineering at Purdue University to become consulting engineer of the Barrett Co., Chicago.

Harris, W. B. has resigned as county engineer of Reno Co., Kan., to engage in private practice.

Walters, Chas. H., has been promoted to chief clerk and engineering assistant, New York State Engineers office, Albany.

Gilmer, D. E., has been appointed engineer of Reno Co., Kan.

Holway, W. R., has resigned as sanitary engineer, Department of Sewers and Water, Tulsa, Okla.

Mensball, H. A., has been appointed first assistant engineer of Kansas State Highway Commission.

Skougor, Hjahnar E., has opened an office as consulting industrial engineer in New York City.

Belknap, Leslie, has been made chief engineer, Michigan State Highway Department.

Cot, W. W., has been made highway engineer of St. Clair County, Mich.

Baldwin, E. W., civil engineer, has opened a consulting office in Tulsa, Okla.

Scruggs, James D., is district manager of the Birmingham, Ala., office of the Richardson Phoenix Co., lubrication engineers and manufacturers, Milwaukee.

Hook, H. L., assistant engineer, Idaho Irrigation Co., has resigned to accept a position with the National Carbon Co., Cleveland.

Fulton, W. L., structural steel and reinforced concrete engineer, has opened an office in Omaha.

Sittinges, Carl J., is in charge of the John A. Stevens engineering branch office, Fall River, Mass.

Holbrook, Frederick, of Holbrook, Cabot & Rollins, contractors, Boston and New York, that have built many great public works, died at Paris, France, February 6.

Blakeslee, G. E., member of New Jersey State Highway Commission, died recently.

NEW APPLIANCES

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations.

Blaw Forms.

For more than ten years units of sectional steel forms for the construction of light walls and foundations have been manufactured and sold by the Blaw-Knox Co., Pittsburgh, Pa., which although now somewhat improved in minor details are still substantially as at first designed.

They are built entirely of steel, the basis being a 24 x 24-in. unit reinforced with flange angles on all sides and through the center, and weighing about 22 lbs.

When assembled they are connected and held in alignment by keys, and are supplemented by fractional panels, lap panels and corner panels.

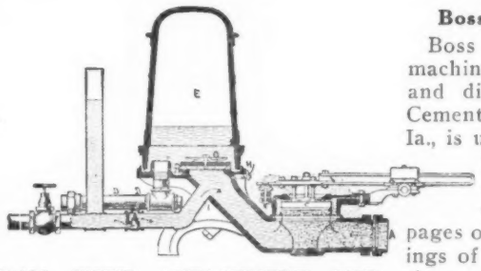
Bulletin 203 has a number of progress photographs showing the forms in position on many important jobs, and has several pages of description of the details of the forms and method of using them illustrated, with sketches and diagrams showing all of the practical operations.

Dumping Motor Trucks Automatically.

An automatic dumping device has been successfully applied to a United States Army motor truck now used by the New York State Highway Department. The truck body was disconnected from the under frame except by a hinge at the rear end and was furnished with a horizontal cross beam at the forward end. To the projecting end of this beam there were connected a pair of hinged struts 11 ft. long, one on each side of the truck. To dump the body, the lower ends of the struts are placed on the ground in advance of the truck and the truck being moved forward while the feet of the struts remain stationary, the latter are pulled into a vertical position, raising the forward end of the body high enough to dump its contents at the rear end, and as the truck advances the struts swing over to the opposite inclination from the vertical and lower the body to its original position on the truck frame, permitting the struts to be lifted up and secured or to trail along if the truck continues to advance.

Rife Hydraulic Ram

The Rife Hydraulic Engine Mfg. Co. issues a pamphlet descriptive of the Rife hydraulic ram suitable for pumping the water supplies for towns, houses, railroad tanks, irrigation and other purposes. It is a strictly automatic machine, operating on the water hammer principle, and can be employed wherever there are three or more gallons per minute available with a fall of 3 feet or more. It can be operated with



RAM WITH ATTACHMENT FOR RAISING CLEAR WATER BY USE OF DIRTY WATER.

dirty water to raise clear water which it can elevate to a maximum of 30 times as high as the operating fall. The largest ram in operation has a 5-inch discharge pipe, weighs 3,000 pounds and develops from 66 to 92 per cent efficiency.

Discharge valve C being open and check valve O being closed, water delivered through drive pipe A escapes through valve C until the diminishing pressure closes it, and the pressure of the moving column of water in pipe A opens valve O in bottom of air chamber E, and water enters, and compresses the air in the chamber until equilibrium is established, the valve O closes, valve C opens enough to permit a small discharge of water and again establish the flow in pipe A and so on, the water being delivered from the air chamber E through the outlet pipe D, under pressure to the tank or receiver.

If it is required to operate the ram with dirty water and elevate clear water from another source, the clear water pipe I is connected to the drive pipe A just below valve O, and water from it passing through a check valve, rises to valve O and is forced into the air chamber without being followed by any of the dirty water. A small automatic valve at H constantly admits air that refurnishes and maintains a supply in chamber E. This ram is recommended for use with a pneumatic tank which provides continuous pressure on a closed supply system. The rams are simple and durable in construction, and easily accessible for maintenance and adjustment. They are easily installed and are manufactured in nine sizes requiring from 2 gallons to 650 gallons per minute for their operation.

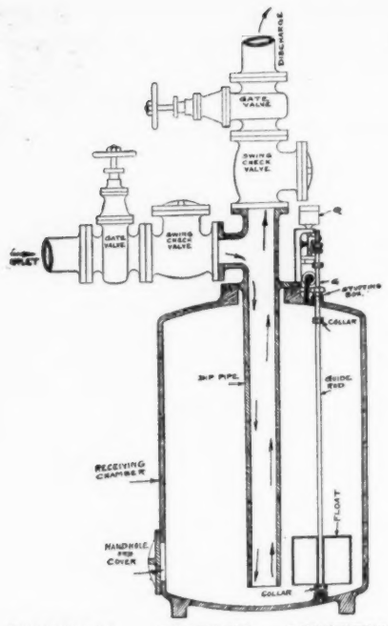
Boss Construction Machinery.

Boss labor saving construction machinery designed, manufactured and distributed by the American Cement Machine Co., Inc., Keokuk, Ia., is used by more than 6,000 contractors and is attractively illustrated and described in catalog 920 by sixty-four pages of diagrams, half-tone engravings of equipment and other operations, supplemented with descriptions and specifications of concrete mixers and mortar mixers, sizes one-half bag to four bags; one and two bag pavers; single drum, double drum and traction hoists; backfillers, material elevators, diaphragms, trench and force pumps, air compressors, saw outfits, and concrete carts, all warranted.

Simplex Sewage Ejectors.

The inlet of the ejector is connected to the lowest point of the drainage system and the sewage passing by gravity through the gate and check valves and stand pipe enters the bottom of the main chamber, raising the copper float and guide rod until the latter operates weight Q and opens the air valve. This admits pneumatic pressure from a storage receiver to the top of the ejector chamber and forces the sewage back up the central stand pipe, closing the lower check valve and delivering the sewage through the upper check valve and gate valve to the discharge pipe. When the sewage is nearly all discharged from the ejector chamber, the dropping of the float valve closes the air inlet valve, the check valves are reversed, opening the inlets and closing the discharge pipes, and the cycle of operations is repeated.

The ejectors are installed as



VERTICAL SECTION SHOWING FLOW IN AND OUT OF COMPRESSION CHAMBER.

single or as duplex units and are provided as required, with air receivers, air compressor and automatic control. They are furnished of any desired capacity up to 1,000 gal. per min. and to operate against heads up to 250 ft. The normal speed of operation is one discharge per minute. These machines are recommended for ejecting sewage from basements at elevations below the level of the street sewer; for raising the sewage in low-lying districts to the main sanitary sewer; for increasing the velocity of flow in existing sewer systems, for handling raw sewage or settled sludge at sewage disposal plants; and for the automatic raising of any kind of fluid, semi-solid or gritty solution.

Lane Electric Cranes.

A new bulletin, entitled "Lane Electric Cranes," has just been issued by N. B. Payne & Co. It illustrates and describes several styles of cranes in which steel girders or heavy timbers of long leaf yellow pine are used. A record of thirty years is claimed for this crane—minimum power and repair cost and great overload capacity. The cranes can be operated by inexperienced labor.

The Pennsylvania State Highway Department will, in 1920, operate their own stone quarries and sand banks under the direction of a new department headed by D. M. Hepburn, Philadelphia.

INDUSTRIAL NEWS

T. L. Smith Company Sales Manager

R. E. S. Geare has been appointed general sales manager of the T. L. Smith Company of Milwaukee, manufacturers of concrete mixing machinery and contractors' equipment. He will be in charge of the company's general sales offices, Old Colony Building, Chicago, where the advertising and sales departments are now located.

For the past four years Mr. Geare has operated under the firm name of Geare & Co., engineers, specializing in sales engineering in the construction and power plant field. Geare & Co., handled the business for the T. L. Smith Company, the Mainstee Iron Works and others.

T. L. Smith Company manufactures the Smith Simplex paving mixer, the famous Smith tilting mixer, non-tilting mixers, pumping machinery, tower equipment, etc.

General Contracting.

The Freeland, Roberts Co., capital stock $25,000, has been incorporated at Nashville, Tenn.

River Improvements.

The Submarine Engineering & Construction Co., Troy, N. Y., has been incorporated with $50,000 capital stock.

Waldo-Bond Consolidation.

The long established firm of Waldo Brothers, Inc., and the Harold L. Bond Co. have recently consolidated in the Waldo Brothers & Bond Company, Boston, dealers in construction equipment and building materials. This arrangement combines two important factors, providing for all kinds of engineering construction requirements, and will cover very nearly the entire field of the general contractors' purchases. The new organization will continue the activities of the old elements, to give a complete service to the contracting and building industry of New England.

Since its inception, eighteen years ago, the Harold L. Bond Co. has developed a large business in engines, hoists, pumps, drills, concrete machinery and general power and hand tools. The Waldo Brothers Inc., commenced business fifty years ago and have been notably successful in the introduction, manufacturing and distribution of Portland cement and in handling bricks, tiles and other building materials.

The new concern will handle and distribute everything necessary for the construction and equipment of buildings and for other important construction work, including nearly all kinds of manufactured building supplies and contractors' plant and equipment. It will issue a new house organ called *Construction Service* for the presentation to the trade of interesting and helpful articles and pictures of current construction jobs, information regarding new equipment or materials, pertinent news articles and editorial comments.

Holway Engineering Co.

W. R. Holway, recently sanitary engineer, Water and Sewer Department, Tulsa, Okla., and formerly with the Water Supply Board, Providence, has organized the Holway Engineering Co., Tulsa, Okla.

Storage Dam Contract Approved.

A tentative contract between the United States and the canal companies and irrigation districts interested in the storage of the Snake river water in Idaho has been approved by Secretary Lane. Plans now being worked out provide for the construction of numerous storage dams. At American Falls it is proposed to construct a high dam across Snake river, creating one of the largest irrigation reservoirs in the United States.

The approaching utilization for irrigation, of a large part of the most available water supply in California indicates that it will soon be desirable to conserve the flood waters of mountain streams, and that the great cost of the impounding reservoirs will necessitate Federal construction, which, wisely conducted, should be quickly repaid by the beneficiaries.

Earth for the embankment of a 100-foot dam in the Happy Valley Irrigation District, Shasta County, Cal., is excavated from the hillside by an hydraulic giant which washes it into a wooden flume carrying it across the valley on a trestle viaduct.

The Cleveland Traction Commissioner, Fielder Saunders, asks for a $2,500,000 bond issue to provide funds to purchase 100 additional cars and trailers; to replace five cars "which are now too small"; to revise power distribution in the interest of efficiency. Three new substations should be built; to double track Clark avenue line. Link Clark avenue and Union avenue lines by tracks on Pershing avenue and operate as crosstown lines; and to construct new cross town line in W. 117th street.